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VOL. XXXII.

JANUARY TO JUNE

1913.

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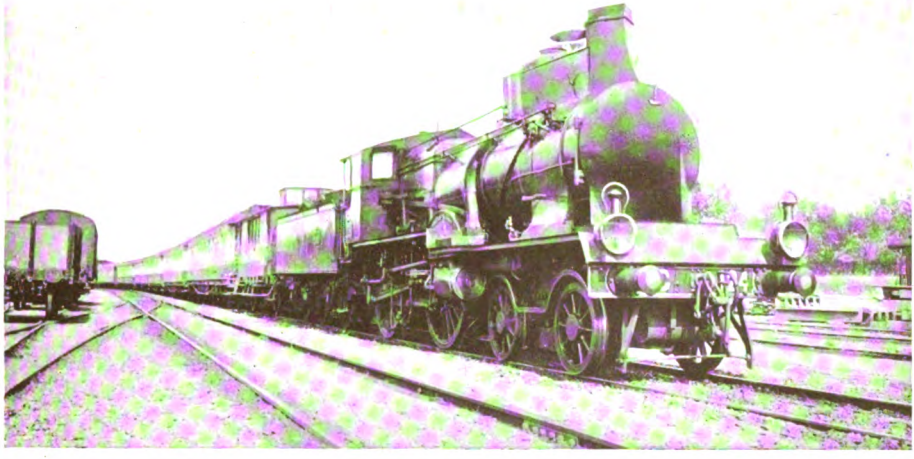

CALAIS—MEDITERRANEAN EXPRESS LEAVING ST. RAPHAEL—VALESCURE.

By Mediterranean-Express.

THE MODERN MAGIC CARPET.

By F. G. AFLALO.

WHAT is there about the very sound of the South that has such magic in it? It is in the daily path of Phœbus. It is the point of the compass whence the swallows come to us in spring, and whither they return before the northern lands are once more wrapped in the gloom of winter. It suggests pale olive groves, terraced beside sapphire seas, feathery palms silhouetted against snow-topped mountains, and skies that rival those of Egypt. It conjures up visions of cosmopolitan crowds, eternal flowers, a riot of colour, warmth and the joy of life. Its gladness invaded Stevenson, and won him from brooding over the fatal malady that in his native land would have sent him to an even earlier grave. Its spell took the Brownings to Florence, and kept the Shelleys at San Terenzo, in days when Continental travel was the business of ambassadors and the luxury of such few as made the Grand Tour.

Perhaps the Grand Tour of to-day has lost some of its grandeur, but its delights are the common property of thousands who avail themselves of this miracle of transport performed by the Sleeping Car Company and the lines with which it works in harmony. They have no need, these *hiverneurs*, to take up their beds and walk, for their beds go with them, and they may sleep through the rapid change out of fog into light, out of rain into sunshine, out of chill into warmth, leaving home in a season when it is anything but sweet, and staying on the shores of the Middle Sea, or in those white resorts perched high over the Swiss lakes, until the air of

The accompanying frontispiece is a reproduction of a coloured picture recently completed by the Sleeping Car and International Express Trains Company, to illustrate the different services enumerated under the heading of "Famous Trains de Luxe," in the last issue of the RAILWAY MAGAZINE. *Mr. H. M. Snow, the Company's Agent-General in London, designed the original, which vividly contrasts the normal winter conditions of the Metropolis and the Mediterranean. The picture has called forth praise at home and abroad, and is generally acknowledged to be the best advertisement ever given to the Riviera.*

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Train de Luxe SLEEPING COMPARTMENT: INTERNATIONAL SLEEPING CAR COMPANY.
As used on Riviera Services, Paris, Lyons and Mediterranean Railway.

Knowing well the gorgeous transformation effected in less than twenty-four hours from the murk of Pall Mall and the Embankment to the golden glory of the Boulevard de la Croisette or Promenade des Anglais, I have sometimes wondered whether those who so impassively watch the train steam out of Victoria on a typical November morning realise that its happy occupants are being translated from the Pit to an earthly Paradise.

When seeing friends off by it, it needs all my self-control not to jump on the train as it moves out. To-morrow morning at this hour we shall still be coughing with lungs full of fog, and blinking through eyes that smart with smoke; but they will be looking out of the windows at energetic golfers playing an early round on the links outside Cannes or Nice. They will have drunk their morning coffee in sight of the back streets of Marseilles, or on Britain is warmed again, and the birds are flying north to their summer love bowers.

Of all the *trains de luxe* in which the Company takes its clients to these delectable lands, none—as those best realise who, early and late in the season, have been unable to secure a single berth on it for days together—is in greater demand than the daily Calais-Méditerranée-Express, which connects with the 11 a.m. train *ex*-Victoria and runs, without a break, or change of carriage, from alongside the boat at Calais to the Italian frontier at Ventimiglia, by way of Paris, Dijon, Avignon, Marseilles, Toulon, Cannes, Nice, Monte Carlo, and Mentone. the viaduct that at Toulon spans the anchorage of warships. They will be gliding smoothly to their journey's ending between villas framed in palm trees, with peeps of the azure sea on one side, and of the foothills of the Alps on the other. Already, even before alighting from the train, they will feel the magic of the Riviera—its blue skies and brilliant sunshine, its flowers and its gaiety. They will be infected with the sense of perpetual youth that is part of that southern winter. Later, an occasional breath of *mistral*—the origin of the name is not, as one might think, associated with mist, but with an old Provençal form of *maître*, in

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allusion to its masterly nature—may damp their spirits, or the cutting *bise* may blow on them from the northern gorges. But without such timely corrective, the southern winter would be too perfect for this life, and the exiles would never want to come home again.

The keynote of life in these resorts is irresponsibility, with a devil-may-careness that has irresistible charm for those who are temporarily freed from the obligations of home. Even on the golf greens, there is a curious lack of invective, just as there is calm philosophy even in the Rooms. The revels of King Carnival win the dourest northerners to enter into the spirit of his brief reign with all the zest of natives who have such frolic in their blood. Hypochondriacs who stepped heavily on the train at Victoria are scarcely recognisable in the debonnair folk next morning strolling jauntily up and down green boulevards beside the sea. Along with their heavy clothing, they seem, like snakes in spring, to have sloughed the torpor of their winter's discontent.

A longing for sunshine and dry days, then must always be the first inducement to book accommodation in this train of our December dreams. There are others, no doubt. One of them, with many people, is the determination to go for the winter where "everybody who is anybody" goes. In itself, this sheepish, follow-my-leader game of Society does not, perhaps, touch any very high ideal; but, for this once at any rate, there is sound reason in the mandate to fly South. The English winter is a better justification than any other for this frenzy of imitation that would otherwise be worthier of parrots, than human beings. There is yet, to be frank, another most potent attraction—a call more insistent in sympathetic ears than any lure of landscape, climate, or company, and that is the monotonous voice of the croupier, whose "*Faitesvos jeux, Messieurs et Dames!*" is a clarion summons to do battle on the green cloth, battle against

SLEEPING CAR COMPARTMENT BY DAY: INTERNATIONAL SLEEPING CAR COMPANY.

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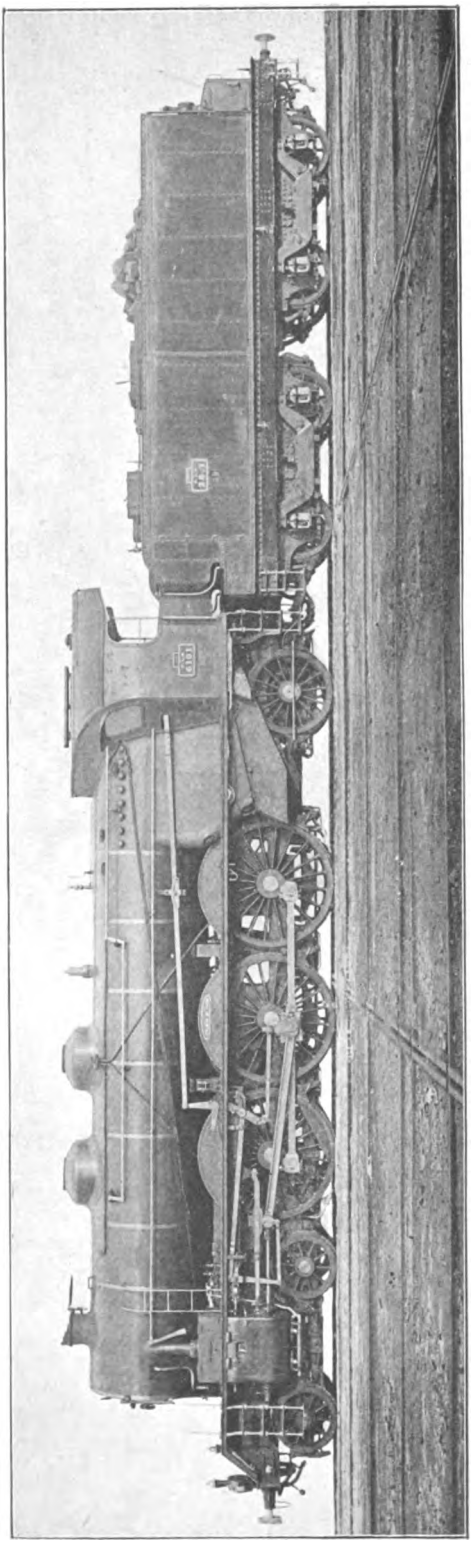

4-6-2 LOCOMOTIVE: PARIS, LYONS AND MEDITERRANEAN RAILWAY.
Some of these engines have four single cylinders; others are four cylinder compounds; but both series are fitted with Schmidt superheaters.

tremendous odds and against a passive, but usually victorious, foe.

Now and again, no doubt, the foe is worsted for a moment, and if the victor has the moral courage to take the Mediterranean-Express in the opposite direction before his luck turns, he may return home with the foundations of a competence. Such rare routing of the Bank is mere luck. System? Yes, there is one, and the Bank plays it, steadily, remorselessly, with no more heat than may be seen in the spin of the wheel or the fall of the cards. Personally, having a limited horizon in these recreations, I find all forms of gambling incomprehensible, but this is an individual eccentricity which I forbear to press, since the majority of my friends think this form of excitement unrivalled as a weapon with which to kill time—an occupation into which they throw themselves so passionately that one would think they had to live a thousand years.

So much, then, for the collective attractions of the Riviera. Their number might be indefinitely added to: the blaze and scent of wild and cultivated flowers, the excellent music, the artistic cooking, the golf and polo and pigeon-shooting, the lawn tennis tournaments and aviation meetings and motor-boat races, all of which help these exiles from the frozen north to live two summers in the year, playing the games of an English June on days when their friends at home are shivering over the fire. The individual claims of the resorts, great and small, which stretch almost continuously from Toulon to Spezzia, are less easily differentiated; but for present purposes the chief of those which lie along the route of the train that inspired this article will suffice. Hyères, Cannes, Nice, Monte Carlo and Mentone are the bright particular stars this side of the Italian frontier, and between them shine a number of lesser lights, each, no doubt, with its own glamour, yet mainly attractive because they combine the opportunity of quiet repose with abundant facilities for reaching one or other of the gayer centres when so desirous.

I pass by the many fascinating halts by the way between Paris and the azure coast.

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Else a word might be said for the exceptional *cuisine* of that fine old post-house at Dijon, the Hotel de la Cloche, or for the view of the Rhone and its broken bridge at Avignon, or the Roman remains at Arles, or the cathedral at Aix (least known among its namesakes), or even the *bouillabaisse* of the Rue des Recoltes at Marseilles. The first of the winter resorts to attract visitors is Hyères, a little beyond Toulon, and Hyères is as careless of the more meretricious attractions of its greater neighbours as in the days when the wife and sister of Bonaparte rested here from the turmoil of Paris under the first Empire. So closely is the little town hemmed in by its guardian hills that the *mistral*, though not absolutely a stranger in its streets, is less liable to make itself disagreeable than anywhere else west of Monaco.

Cannes appeals to very different tastes. Here is no rest cure, though I imagine that anyone anxious to keep himself to himself might succeed in the garden of his villa, or even in the bedroom of his hotel. He might even find security from interruption out on the Iles des Lerins, where I have strolled along the shore for an hour without meeting a living soul ; and there are lovely solitudes, a little off the track of motor cars, around the Gorges du Loup, where I know more than one little glen hidden from the road, and carpeted with the flowers that Grasse perfumeries crush to living essence for the toilets of London and other cities of the wintry night. Cannes itself, however restful its suburbs, is certainly, for those in the *mouvement*, one long round of gaieties, with golf on the links, bridge at the Cercle Nautique, baccarat at the Casino, *le flirt* at the polo ground, tea *chez* Rumpelmayer, and a dance or dinner party to end the long day of pleasure.

CANNES : GENERAL VIEW.

Its social world is a little divided in *côteries*, with a Russian Grand Duke and a French Count as rival stars of first magnitude, and an outer series of lesser constellations who have an equally good time of it in accordance with their tastes and means. It is pre-eminently an English resort. There are good patriots who sincerely believe that it was discovered by Lord Brougham, but these people would as readily insist that an Englishman discovered the universe. No ; the town existed in Roman times, though that arrogant and eccentric statesman, of whom even his nearest colleagues tired at long last, certainly

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MONTE CARLO: THE TERRACE.

built him a villa there which may be regarded as the nucleus of the English colony that has, since his day, made the place peculiarly its own. It is perhaps as a result of this preponderance of the perfidious that Germans patronise Cannes but sparingly, infinitely preferring Monte Carlo, where the sons of and daughters of the Fatherland are present in numbers rivalled only by the contingent from Columbia.

Nizza la bella is, of its kind, incomparable, and it differs from every other resort between Marseilles and Genoa, if only by its size. Here is no mere town, with a small resident population trebled by winter visitors *en villegiature*, but a great city of not far short of a hundred and fifty thousand inhabitants, with ancient traditions, established industries, and an atmosphere of its own that no political tinkering of the map can affect. Nice is as Italian to-day as it was before 1860. All that is most lovable in Riviera scenery is to be found in its surroundings—with the palms and almond blossom, the vineyards and olive groves, the lemon trees and mimosa and oleander, the roses and the violets, and the wondrous backgrounds of mountain snows. Its carnival is the most elaborate in all Provence, and the culminating Battle of Flowers on the Promenade des Anglais is an unforgettable spectacle.

Monte Carlo has but one association. The Rooms, with the annexe of the Sporting Club across the road, are the Mecca of gamesters from all the world over. And it is here that the student of what the poet calls the "proper study of mankind" may ponder on the most amazing jumble of types. Here he may find half Debrett cheek by jowl with absconding bank clerks, *demi-mondaines*, country parsons, actresses, peeresses, dowagers, *débutantes*—surely the most amazing omelette compounded of even such ingredients. Even for those who are cold to the lure of the green cloth, who are deaf to the wiles of the croupier, who have no desire to win and an intense hatred of losing, find a nameless fascination about the humanity that crowds this Temple of Chance. If the eyes are truly the windows of the soul, then indeed some of these souls have curiously inhuman expressions. It is the fascination of hazard that draws most of its votaries to "Monte." Few have any time for the beautiful music played daily by Ganne's orchestra, fewer still any eyes for the scenery of the road along the cliffs. Yet there are other joys than losing money. The golf links up at La Turbie — if as yet needing the hand of time to soften their defects—can, at any rate, boast finer air than the majority of courses on this earth. Then there is the Terrace, most attractive of seaside promenades, its peace disturbed only by the continuous fusillade of the pigeon-shooters down below.

Monaco, too, is worth a visit, and even those who take no academic or commercial interest in the exhibits, find something to admire in the well-arranged Museum of Oceanography which thanks to the tastes and generosity of Prince Albert forms, on its conspicuous headland, a striking monument of the truth that "good may come out of evil." The Prince, who derives his handsome income from a trifling percentage on the takings of the Casino, not only never plays himself, but actually devotes the bulk

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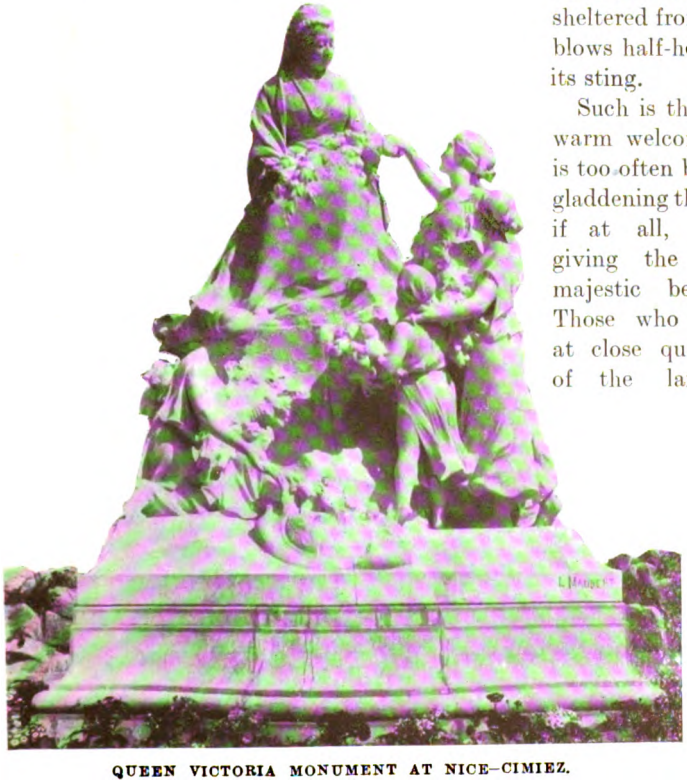
of his fortune to the services of marine biological exploration. In an even greater degree than its neighbours, Monte Carlo is the wrong place to go to for a rest cure. Its patrons return year after year for excitement as an antidote to the slow poison of the humdrum business life. Those who, on the other hand, like their excitement to order, with intervals of calm between, make Cap Martin or Mentone their headquarters, since in a few minutes they can be transported to the glitter of the Rooms. Of all the resorts on this blest shore, I imagine that Mentone bears the palm for softness of climate. On the eastern side more particularly, along the Boulevard de Garavan, it is so effectually sheltered from the west that even the mistral blows half-heartedly and seems to have lost its sting.

NICE: GENERAL VIEW.

Such is the Riviera that, in winter, gives warm welcome to those whose motherland is too often but a stepmother at that season, gladdening the eyes of many who like snow if at all, in generous perspective as giving the finishing touch to the majestic beauty of distant mountains. Those who prefer their snow and frost at close quarters flock to the winter sports of the land beyond the Maritime Alps, but for all who can appreciate the bluest of seas dancing under the bluest of skies, the best of the Riviera weather spells perfection, and the worst can be endured in the comforting knowledge that the sun will shine again to-morrow.



QUEEN VICTORIA MONUMENT AT NICE—CIMIEZ.

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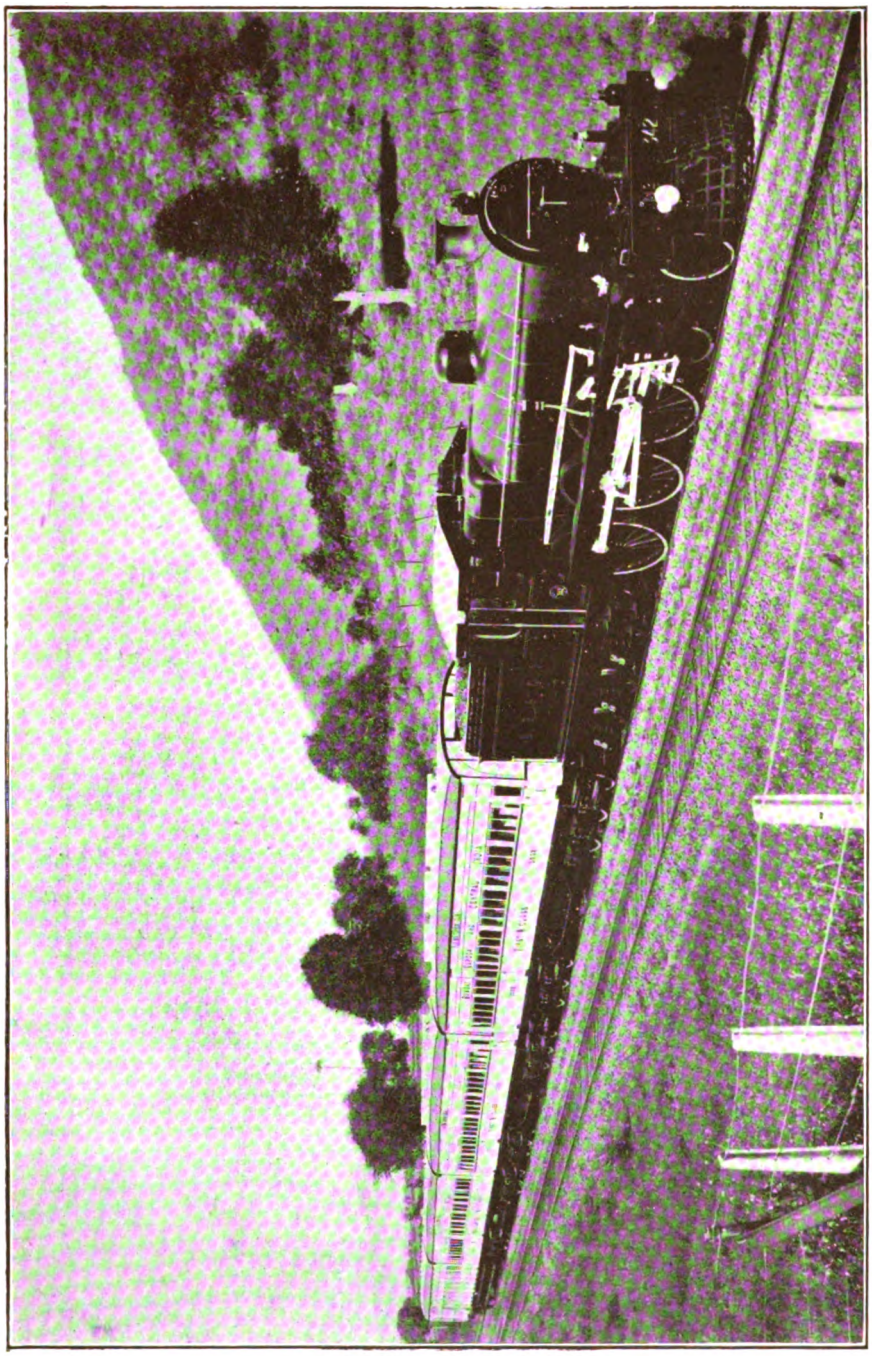

BOMBAY, BARODA & CENTRAL INDIA RAILWAY:
New P. & O. Express Train.

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Photo] [*F. E. Mackay.*

ISLE OF WIGHT EXPRESS: LONDON, BRIGHTON AND SOUTH COAST RAILWAY.
4-4-0 Locomotive No. 68.

Winter Resorts in the Homeland:

THE ISLE OF WIGHT [No. III].

THE Isle of Wight enjoyed popularity as a Winter resort when the annual holiday exodus in the United Kingdom was small in comparison with its present proportions —when the Riviera had hardly begun to cast its alluring spell over two continents, and when the attractive spots on the shores of the Homeland were few in number. But during the last half-century the conditions have undergone an extraordinary change. The stream of pleasure traffic to places abroad has year by year expanded, until services, which, formerly poorly patronised, if not actually unremunerative when provided only once a week, are now crowded daily from November to May. At home another transformation has simultaneously been in progress. All round our coasts little spots that were at one time hardly indicated on the maps have sprung into fame, helped in the process of development by cheap and rapid railway facilities. There is, indeed, hardly any part of England and Wales where growth of the kind has not been witnessed. The Scottish seaboard has been equally active, especially since golf began to fascinate such a large number of people, and Ireland can certainly claim to have had its full share in the general advancement. In the circumstances, the choice of holiday grounds has become almost perplexing in its variety. The fortunes of some of the older resorts have been severely tested ; but, to deal with the altered situation, a new spirit of enterprise is called forth, and wherever this exists success continues. There is a quiet charm in many genial spots on our own shores which no one can dispute, and to the busy worker there are, particularly during the winter months, few more pleasant places than the Isle of Wight.

Passenger traffic to the island is conducted by the London and South Western and the London, Brighton and South Coast Companies. The services of the former, as already indicated, are eleven to Ryde and six to Cowes on week-days, three to Ryde and one to Cowes on Sunday, with similar accommodation on return. From Victoria or London Bridge there are during the winter months seven trains on week-days, with an extra one on Saturday, and two on Sunday, Christmas Day, and Good Friday. In the opposite direction

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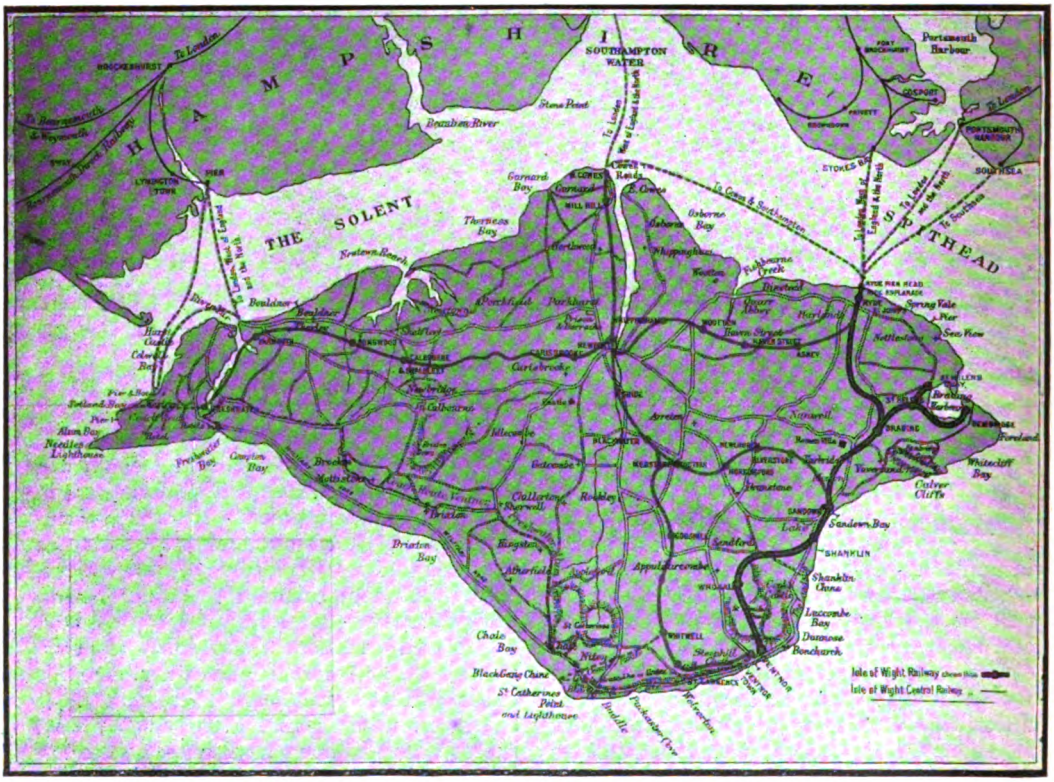
eight trains start from Portsmouth Harbour on week-days, with an additional one on Monday morning, and there are two on Sunday, Christmas Day and Good Friday. The Isle of Wight is also approached from Bournemouth, Weymouth and Portland, *viâ* Southampton and Cowes, *viâ* Portsmouth and Ryde, or *viâ* Lymington and Yarmouth; and in conjunction with the various steamer and rail services convenient connections are made with trains to and from the North and the Midland counties operated by the London and North Western, Great Northern, Midland, Great Western, Great Central, London and South Western and other railways.

All the chief places in the island are reached by rail from Ryde or Cowes, and there are two systems—one owned by the Isle of Wight Railway Company, the other by the Isle of Wight Central Railway Company. The former was incorporated in July, 1860, and its direct line, 12 miles in length, extends to Ventnor, with a branch of 2¾ miles from Brading to Bembridge. Mr. H. K. Day is Secretary and General Manager, and the chief offices of the Company are at Sandown.

The Isle of Wight Railway serves a number of the favourite winter resorts. From the time-tables covering the period October 1st, 1912, to May 31st. 1913, it will be seen that Sandown and Shanklin can be reached from Waterloo (London and South Western), Victoria or London Bridge (London, Brighton and South Coast) in a trifle over three hours, and and Ventnor in less than three hours and a half. Weekly season tickets are issued to tourists at 7s. 6d. first-class, and 5s. 6d. third-class. These tickets are available for seven days between all stations on the line and by all trains, and are exceedingly useful to those who like to combine walking tours and return journeys by rail. Through weekly season tickets may also be purchased —20s. 6d. first-class, 15s. 6d. third-class— and these enable the holders to travel to every station on the island in the trains of the Isle of Wight Central Company as well as in those of the Isle of Wight Company.



RAILWAY SYSTEM OF THE ISLE OF WIGHT.

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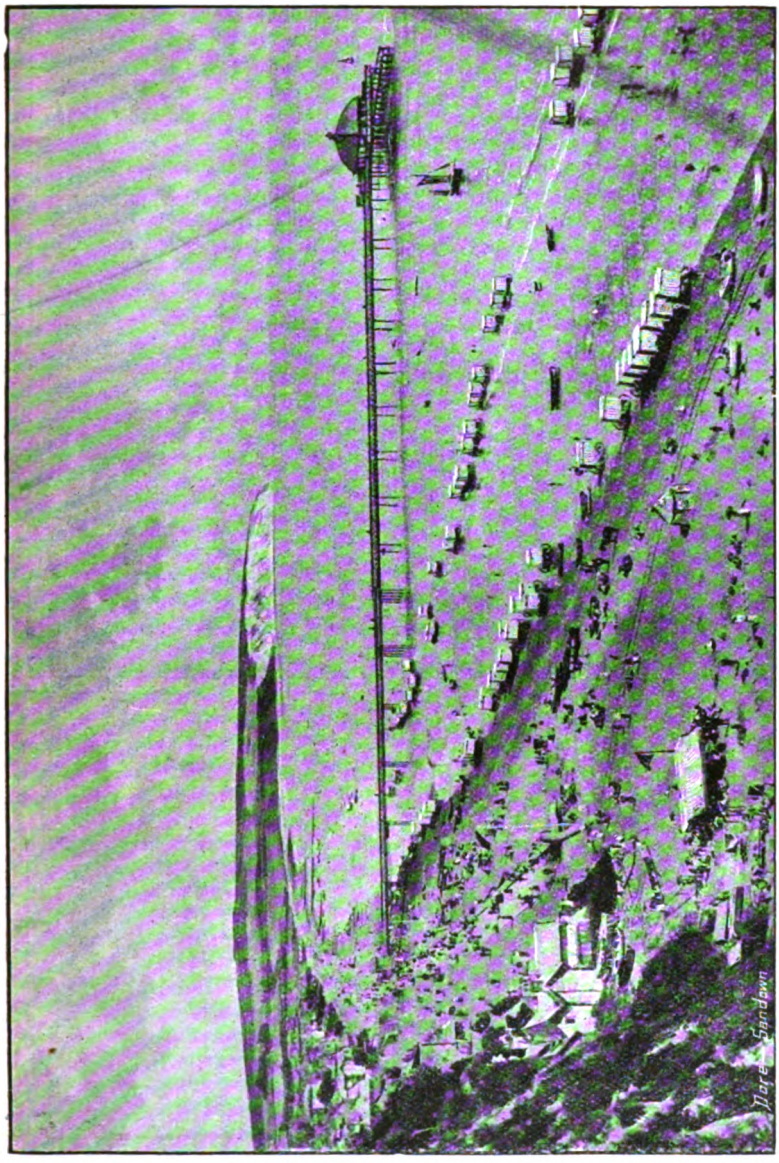

SANDOWN.

of Wight Central Railway, which was formed by the amalgamation of three railways—the Cowes and Newport, Isle of Wight (Newport Junction), and Ryde and Newport. The Freshwater, Yarmouth and Newport Railway (12 miles), and the Newport, Godshill and St. Lawrence Railway (7 miles), are also managed and worked by the same company. This system embraces all parts of the island, there being branches from Newport (in the centre) to Cowes in the north, Ventnor and St. Lawrence in the south, Ryde and Sandown in the east, and Yarmouth and Freshwater in the west. Ryde Pier and Cowes trains connect with regular steamboat services to and from Portsmouth and Southampton, and at Sandown and Ryde (St. John's Road), with the Isle of Wight Company's trains. During 1912 third-class facilities have been gradually extended by the Isle of Wight Central Company, until at the present time 1d. per mile fares are in operation by virtually all trains. Weekly season tickets available over 40 miles of railway are issued at 7s. 6d., second-class. At Medina Wharf, on the River Medina, near Cowes, considerable shipping is dealt with, including the principal coal supplies for the island. Mr. Russell Willmott is the Secretary, General Manager, and

First-class 250-mile tickets represent another facility introduced in recent years. For these the charge is £1 12s., or about 1½d. per mile—a large reduction on the ordinary fare. Each representing a mile, the coupons have to be exchanged at the booking office of the departure station for a single or return ticket as required, and the tickets enable holders to travel between all stations on the Isle of Wight Railway during the period for which they are available until the coupons are exhausted.

Similar arrangements are made by the Isle

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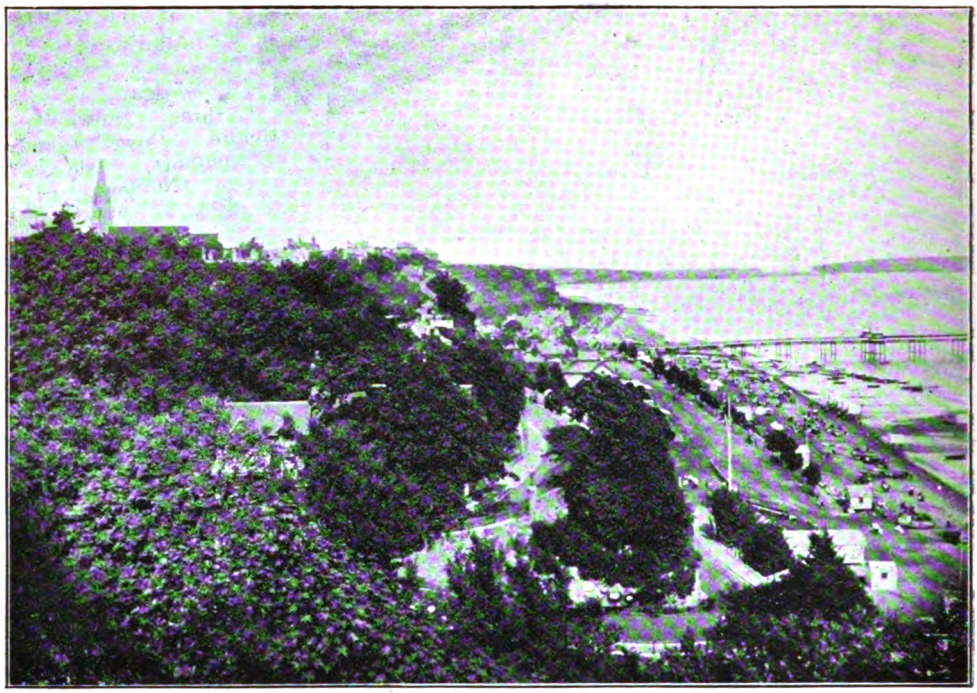

SHANKLIN.

VENTNOR.

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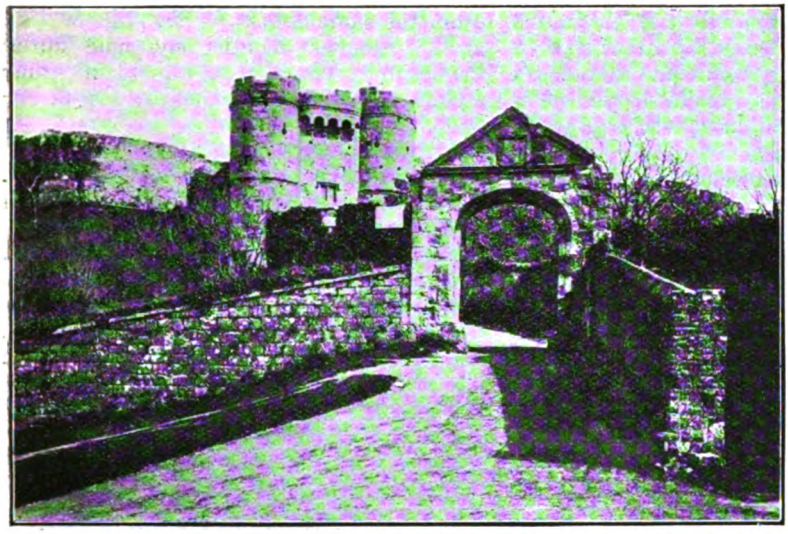
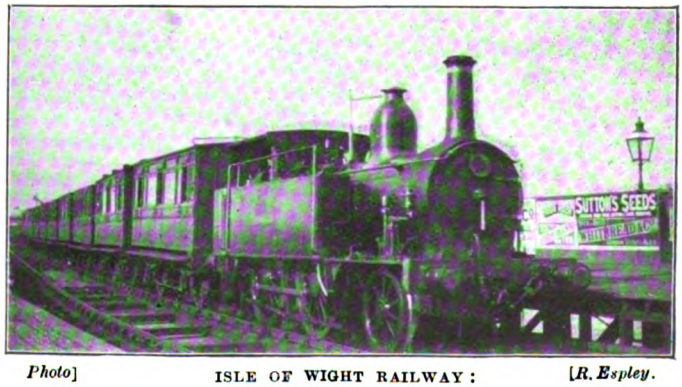


CARISBROOK CASTLE.

Engineer of the Company, whose headquarters are at Newport.

Ryde, the principal port of entry to the island, occupies an eminently favourable position, commanding uninterrupted views of the Solent and Spithead, and therefore of perpetual activity in the movement of vessels of every type in the Royal Navy. From the foreshore the town rises somewhat abruptly, giving to the sea frontage quite a picturesque aspect. The berths at the pier provide accommodation for three channel steamers. At times it would be an advantage if a fourth could simultaneously go alongside, but up to the present it has not been deemed wise to enlarge the structure. Quite close to the landing places stands the station used jointly by the island railways, and parallel with the lines an electric tramway belonging to an independent company runs to Ryde Esplanade station. The pier, about half a mile long, affords a breezy promenade and is the scene of a good deal of pleasure In a circular pavilion standing between the tramway terminus and the railway station entertainments are provided during the summer months, and in winter the floor is given up to roller skating, which has for many years been a favourite pastime with visitors and residents. The station of the National Lifeboat Institution, the pier, is also the headquarters of the Vectis Rowing Club, and the Royal Victoria Yacht Club have rooms in the Pavilion. Swimmers and fishermen have the use of the Victoria Pier, a shorter structure on the east side of Ryde Pier, and the attractions of the foreshore include a large canoe lake for rowing boats and model yachts. Effectively laid out, the Marine Gardens are well patronised in summer and winter alike. Extending for a considerable distance along the sea front, in extension of the Esplanade, they contain numerous flower beds, a capital bowling green whereon championship tournaments are played every year, equally well-kept tennis courts, and a bandstand which, throughout the summer, is the centre of many musical promenades. At the western end of the Esplanade a larger pavilion has been erected, surrounded by parterres, lawns and spacious walks, and here last summer the fine band of the Royal Marine Artillery, conducted by Lieutenant B. S. Green, gave daily performances which were much enjoyed by large audiences. It is generally acknowledged, however, that, to make Ryde more popular in the winter some permanent attraction of the kind is much



Photo] ISLE OF WIGHT RAILWAY: Train on Ryde Pier. [*R. Espley.*

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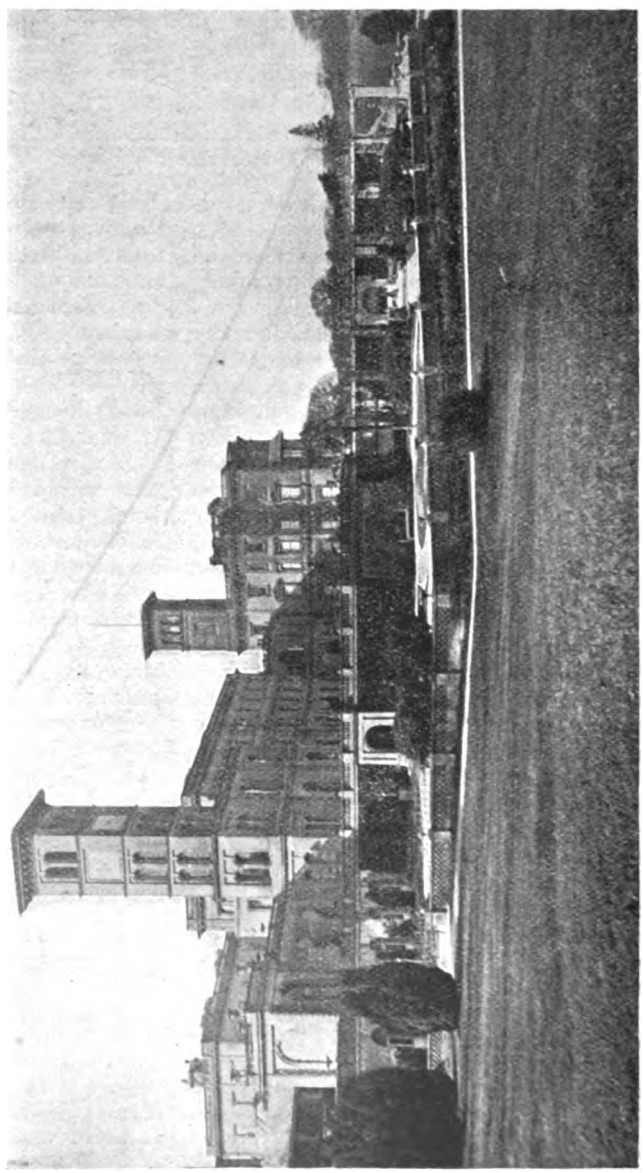
needed, and the proposal has, therefore, been made that a Kursaal or other similar place of indoor entertainment should be established in close proximity to the pier. There can be little doubt that a loan could be raised in the usual way, and the cost spread over a considerable period, without imposing more than an infinitesimal burden upon the ratepayers.

Sandown, the first of the chief winter resorts approached from Ryde, is able to show a splendid meteorological record. Its success dates from the visit of the Crown Prince and Empress Frederick of Germany in 1874, and the benefit which the royal patrons derived has since no doubt been shared by thousands of others. Here are beautiful firm sands, a fine pier, and above all the magnificent Sandown Bay.

Shanklin is situate in the most beautiful part of the Garden Isle, on high ground, facing south-east, and affording a commanding view of Sandown Bay and the English Channel. Sea breezes, gentle and health-giving, prevail throughout the year, and the climate is distinctly bracing. Indeed, Shanklin has every natural advantage, and possesses all that can be desired in a modern seaside resort. The triple climate of Shanklin is a natural advantage. Dr. Dabbs, who practised many years in the town, writes: "The climate on the New Road is so different from that on the cliff; that of the cliff so distinct from the shore climate." Shanklin is cool in the summer months and mild during the winter. The famous Shanklin Chine is only one of many beautiful walks in the town.

Ventnor is pre-eminent in the heart of the lovely undercliff district of the island. The mildness of its winter climate is such that sub-tropical plants flourish out of doors continuously, and make it an ideal place for invalids; but in summer the air is cool and invigorating. The position of the town on the terraced slope of the Downs, which rise to a height of 800 ft. within



OSBORNE.

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little more than half a mile from the sea, has earned it the title of "Malvern by the Sea."

THE STATE APARTMENTS AT OSBORNE.

It was a great disappointment to the Isle of Wight as a whole, and to East and West Cowes in particular, when the abandonment of Osborne as a royal residence was announced. But the public generally have certainly no reason to complain, inasmuch as by the late King Edward's munificence the public have been granted in perpetuity permission to visit the State apartments while a large part of the upper floors are now devoted to the purposes of a convalescent hospital for navy and army officers, and in the grounds a college for the training of naval cadets has been established, to the pecuniary advantage of residents in the district. In the State apartments visitors coming from distant parts of the earth have an opportunity of seeing the remarkable collection of presents which Queen Victoria received from India and many other parts of the Empire. The suite of noble rooms and corridors in which these treasures are effectively displayed occupy the greater portion of the ground floor, where the only area devoted to other purposes is a section belonging to the convalescent hospital for naval and military officers, to which the public are only admitted when visiting patients.

Access to the State apartments is given by the Durbar Wing, and from the entrance the visitor passes at once into the Durbar Room, which in every detail is typical of Indian design and decoration. This chamber is 60 ft. long, 30 ft. wide, and 20 ft. high, and the whole of the beautiful interior was completed under the personal supervision of Ram Singh, a well-known Indian architect. A dado of teak, with plaster panels, extends round the walls, and above these are extremely delicate patterns formed in plaster. The ceiling is deeply panelled, with moulded and enriched ribs, and over the handsome fireplace is a representation of a peacock, elaborately executed in the same fibrous material. At the further end of the room is a gallery, with three central arches, resting upon teak pillars, and flanked by rich oriels. White, it will be recognised, plays a conspicuous part in the treatment skilfully and artistically adopted.

Eight large cases arranged down the centre of the floor contain the Jubilee addresses presented to Queen Victoria. They came from every part of the British dominions, and many are enclosed in costly and wonderful caskets of gold, silver, or ivory. Grouped around in various places are a sideboard, a four-fold screen, vases, and antique furniture—all exhibiting the remarkable skill of the native Indians in carving. There are also several elbow chairs (one of which was used by her late Majesty), a gun captured at Tel-el-Kebir in September, 1882, and presented by Admiral Lord Alcester, couches, hassocks covered in velvet, and a magnificent gilt table, topped in gold embroidery on blue. From the Durbar room visitors walk through the billiard room (where the original table remains) into the drawing and dining rooms. It was in the bedroom above the latter that Queen Victoria died, on January 22nd, 1901, and a brass plate fixed upon the floor of the dining room marks the spot where the body was reverently placed in a *chapelle ardente* pending the interment at Frogmore.

The public are admitted to Osborne from April 1st to September 30th on Tuesday and Friday, between 11.30 a.m. to 5 p.m., and from October 1st to March 31st on Fridays only, between 11.30 a.m. to 3.30 p.m. On Easter Monday, Whit-Monday and the August Bank Holiday the State rooms are also thrown open, instead of on Tuesdays in the same weeks; but on Christmas Day and Good Friday the doors are always closed. It was on May 3rd, 1904, that public inspection was first permitted, and from that date to the end of January, 1912, no fewer than 462,462 persons had availed themselves of the privilege, giving a yearly average of nearly 60,000. Many visitors drive from West Cowes, while others cross the River Medina to East Cowes by the ferry or the floating bridge, and are then less than a mile from the entrance gates to Osborne.

Strangers are not allowed to enter the range of bungalow buildings which form the College for Naval Cadets, wherein accommodation is provided for 420 candidates seeking commissions in the Royal Navy, nor is there general admission to the engineering workshops at Kingston, where an important branch of the Admiralty training is given. The hospital for naval and military officers, one of the best equipped in the world, has already proved of great value to both services. There are 50 beds, and the officers received are selected by the Directors General of the Navy and Army Medical Departments. The royal kitchen garden is reserved for the use of convalescent officers, and the large expanse on

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Mount Lawn, where troops were once reviewed, is also at their disposal for croquet and lawn tennis. Many trees planted either by members of the royal family or by guests from foreign courts are seen in different parts of the thickly wooded estate, covering more than 1,950 acres, and even during the coldest days of winter the surroundings are full of charm. After they leave the State apartments, visitors may be advised to see the Swiss Cottage and the gardens which were originally cultivated by the late King Edward and his brothers and sisters when they were children. The implements they used are carefully preserved in the tool-house, each bearing the name of its original owner. Mr. Arthur I. Durrant, secretary to the Osborne House Committee and consulting staff, has, with the sanction of the First Commissioner of His Majesty's Works, published an exceedingly valuable handbook to Osborne, with a catalogue of the contents of the State apartments, and copies of the same may be purchased at 4d. each in the keeper's lodge at the Prince of Wales's entrance. The writer has to thank Mr. Durrant for permission to reproduce the accompanying excellent view of Osborne.

Cowes itself, on the opposite shore of the Medina, is seen at its best during the week in August, when yachtsmen assemble from many countries for the racing. Last year a deluge of rain robbed the gathering of all its beauty, but happily experiences of the kind are rare. Cowes Castle, the headquarters of the Royal Yacht Squadron, remains the most exclusive club in the world, and the old town is always interesting.

The following is an official list of the golf links in the Isle of Wight :—

Railway Station.	Club.	Secretary's Name and Address.	No. of Holes	Green Fees.
Cowes	Cowes Golf Club.. ..	E. Hodgkinson, Claymore, Cowes	9	2/- day 7/6 week 20/- month
Freshwater	Freshwater Golf Club ..	C. H. Hill, Valentine Mount, Freshwater	18	2/6 day 10/- week 20/- month
Freshwater or Totland Bay Pier	Needles Golf Club ..	Dr. C. H. Hands, Glendalough, Totland Bay	18	2/6 per day 10/- week 20/- month
Sandown	Shanklin and Sandown Golf Club	Capt. C. Hunt, Sandown, I.W.	18	2/6 day 10/- week 30/- month
Shide (via Ryde) ..	Newport Golf Club ..	E. W. Avenell, Lugley Street, Newport, I.W.	9	1/6 half-day 2/6 day. 5/- week 15/- month
St. Helen's	Royal Isle of Wight Golf Club	M. Tabuteau, Bembridge	9	2/6 day 10/- week 30/- month
St. Helen's	Isle of Wight Ladies' Golf Club	Miss Sale, 42, Melville Street, Ryde, I.W. ..	18	2/- day 7/6 week 12/- fortnight 15/- month
Ventnor	Ventnor Golf Club ..	Capt. Burt, R.N., S. Fernleigh, Ryde ..	9	2/- day 7/- week 20/- month
Whitwell	Chale Golf Club ..	H. Way, Chale, I.W. ..	9	1/- day 5/- week.

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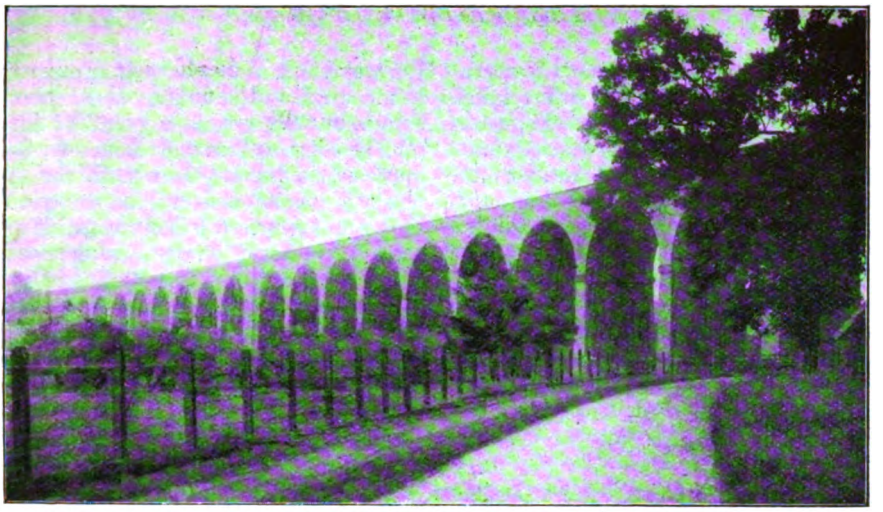

Photo] [*G. M. Perkins.*

HOOBROOK OR KIDDERMINSTER VIADUCT.

The Oxford, Worcester and Wolverhampton Railway. [No. 1.]

By HERBERT RAKE.

ON March 19th, 1844, the Mayor of Worcester presided at a "very respectable" gathering of the residents in that city, for the purpose of hearing a statement respecting the proposal by the Great Western Company to construct a railway from Oxford to Worcester, and by way of Kidderminster and Dudley to Wolverhampton, the object being to connect the Staffordshire coal and iron districts with the broad gauge system. There had been before Parliament a narrow gauge project called the "Grand Connection" Railway, which was to run from Wolverhampton to Stourbridge, Kidderminster and Worcester, it being intended to ultimately connect by way of Droitwich with a suggested Worcester, Warwick and Rugby Railway. The preamble was declared proved, but the Bill was eventually rejected on the strenuous opposition of the Birmingham Canal Company and the landowners of the district, who contended that it would "destroy the beauty of the County of Worcester"!

The meeting held at Worcester declared unanimously in favour of the Oxford line, and at a meeting in Kidderminster the Great Western secured a majority of three to one. Another scheme had meantime matured, under the influential support of the London and Birmingham Railway, in a project for a line from Worcester, by way of Warwick and Leamington, connecting with the London and Birmingham main line at or near Coventry. Feeling ran high as to the merits of the schemes, and in November, 1844, a town's meeting was called at Worcester, where the partisans of the rival projects indulged in a lively passage of arms. The enquiry was made on behalf of the supporters of the Great Western as to the reason for Worcester residents going fifteen miles out of their way to "be placed in Coventry," which elicited a retort from the solicitor appearing on behalf of the London and Birmingham to the effect that "the citizens of Worcester would be well advised to shun the broad way which leadeth to destruction." This assembly broke up in disorder, but not before a motion had been declared to be carried in favour of the Oxford and Great Western Railway connection. Nevertheless, the Railway Commissioners of the Board of Trade reported in favour of the Leamington and London and Birmingham Railway connection.

Meantime another project had been set on foot by the influential mining and commercial interests of South Staffordshire,

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who had applied to the Great Western Company to support and lease a line from Wolverhampton to Banbury, on the route of the proposed Birmingham and Oxford Junction Railway. Both the Worcester and Wolverhampton line and the Banbury Junction line had been planned *viâ* Dudley. A meeting was held at Dudley in September, 1844, to consider the best mode of obtaining the most eligible railway communication with that town. The Grand Junction Railway stood pledged to the Board of Trade to make a branch to Dudley, and the Birmingham and Worcester Company had surveyed a line from Bromsgrove to Droitwich and Stourbridge with a view to its continuance to Dudley and Wolverhampton, whence they could reach London by a route of 13 miles less than the proposed Oxford and Worcester line. It was, however, asserted that in going from Dudley they would save two hours, and that the journey to London would not occupy over five hours. It was resolved to support the Oxford and Worcester line as affording the best communication with the mineral industries of the district, as also with the south of England and with London. A meeting at Stourbridge in October, 1844, was reminded that "they would get to London in a much shorter time than by going to Birmingham, and if they got to Wolverhampton they would have the advantage of a line from there to Shrewsbury and Liverpool."

Worcester had, as shown, pronounced unanimously in favour of the Oxford, Worcester and Wolverhampton line, but the Mayor was induced to call another meeting in November, 1844, for the following reasons: (1) the London and Birmingham Railway had altered their proposed line from single to double, and substituted Tring for Weedon as a point of junction. (2) The Birmingham and Gloucester Railway proposed to deviate their main line so as to bring it to Worcester, and extend it to Wolverhampton. (3) The Oxford, Worcester and Wolverhampton by arrangement with the Wolverhampton and Banbury Junction, had adopted a direct course from Evesham by Chipping Camden, instead of going round by Banbury. The London and Birmingham Railway had already issued Parliamentary notices for a line from a junction at Tring to run *viâ* Aylesbury, throwing out a branch to Oxford, proceeding to Worcester, and thence to Wolverhampton. To ensure the passing of the Bill, they proposed that the railway should be mixed gauge from Oxford, and the Birmingham and Worcester, as a narrow gauge line, were offered running powers into and out of a proposed joint station at Worcester.

Photo] [*G. M. Perkins.*

STOURBRIDGE JUNCTION: EAST END.

Both broad gauge lines, the Bristol and Gloucester and Cheltenham and Great Western Railways brought their respective forces to bear upon the battle that would probably decide which of the gauges would control the future destiny of railway enterprise. On the other hand, at a public meeting held at Droitwich the inhabitants determined to petition Parliament in favour of the Birmingham and Gloucester deviation line, declining to entertain the Oxford, Worcester and Wolverhampton connection. The various Bills came before a Select Committee of the House of Commons in July, 1845, and great excitement prevailed during the inquiry. After a sitting of 30 days, the Committee reported that they

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found the preamble of the Oxford, Worcester and Wolverhampton line proved, and rejected the Bill of the London and Birmingham and also that of the Birmingham and Gloucester Railway deviation line. The avowed intention of the Great Western Railway to carry a line through to the Welsh coast, in order to compete for the Irish mail and passenger traffic, was believed to have exercised some influence on the Committee, who considered that the broad gauge lines were so planned as best to answer the wants of the districts through which they passed. Subsequently the Committee advised that the Birmingham and Gloucester Company should have permission to use the Worcester loop at a remuneration to be fixed by umpires, and on August 4, 1845, the Royal Assent to the Bill of the Oxford, Worcester and Wolverhampton Railway was notified.

The plans seem to have been referred to the Railway Department of the Board of Trade, which recommended the narrow gauge to be laid to the north of Oxford, the break of gauge to be provided for there; but on going before the House of Lords a decision was given, after a protracted inquiry, in favour of the Great Western connection to Worcester, as it would afford the means of uniting the Welsh Midland, which had been projected on the broad gauge, with their main line. But though sanctioned on the broad gauge, the Company were bound to lay down a narrow gauge rail, if required to do so by the Board of Trade. The Act was obtained on August 13, 1845, the authorised capital being £1,500,000, in shares of £50 each, with borrowing powers to the extent of an additional £500,000. It was stated in the prospectus that the railway was to branch out of the Grand Junction Railway at the station near Wolverhampton, and pass by way of Dudley to Stourbridge through valuable mineral property and a densely populous district. From Stourbridge the line would proceed to Kidderminster, and thence to Droitwich, and between Kidderminster and Droitwich a branch line would be made to connect the railway with the Birmingham and Gloucester line. From Droitwich the line would go on to the city of Worcester, where there would be a branch of about one mile to the Severn, for the purpose of communicating with wharves on that river for the shipment of goods. The line would cross the Birmingham and Gloucester Railway about four miles from Worcester, and proceed near Pershore and Evesham, Honeybourne, Chipping Camden, and Moreton-in-the-

Photo] [*G. M. Perkins.*

WOLVERHAMPTON (LOW LEVEL) STATION: SOUTH END.

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Marsh, to a junction at Wolvercot with the Birmingham and Oxford Junction Railway. This Act contained a proviso rigidly preserving Wolverhampton through traffic for London to the Birmingham, Dudley and Wolverhampton Railway.

In 1845, a line had been projected from Cheltenham to Oxford by way of Northleach, Barford and Witney, joining the Oxford and Worcester line at Shipton, whence it was to run for 20 miles on the rails of the latter, towards which the directors, in conjunction with the Great Western, decided to subscribe one-third of the required capital. The first half-yearly meeting was held at Worcester on February 24, 1846, when the resolution of the directors to subscribe £100,000 towards the projected Birmingham, Dudley and Wolverhampton Railway was confirmed by the proprietors. This undertaking was for a railway to bring Birmingham into communication with Dudley, and at the last-named town, as also at Bilston, it would join the Oxford, Worcester and Wolverhampton line. At the second half-yearly general meeting, held on August 28, 1846, it was announced that the Bill of the Birmingham, Dudley and Wolverhampton Railway, towards which they had been empowered to subscribe, had passed, but that for the Cheltenham and Oxford had been lost on its merits. A portion of the Stour Valley line had been passed by a joint arrangement, the Birmingham and Dudley taking one portion and the Stour Valley another. Mr. Brunel, the engineer, reported that the works "were advancing generally to the north of Worcester. The contracts for the tunnel near Campden and the tunnel at Worcester had been let; also that portion from the junction with the Birmingham and Gloucester Railway at Abbot's Wood to the junction with the same railway at Stoke, which will form the main line for north and south traffic through Worcester."

At a special meeting held on March 5, 1847, the directors were empowered to proceed with the Bill before Parliament to make a railway from their main line at Evesham to the Great Western at Cheltenham, to connect with their own branch at Stratford and with that of the Oxford and Birmingham, from Stratford to Birmingham, in conjunction with branches from Stratford to Warwick and Leamington, thereby completing the communication between Cheltenham and those districts, and affording a broad gauge communication from Worcester to Cheltenham, Gloucester, Oxford and Bristol. A further Bill was for connecting the important iron and coal district of Halesowen with the main line at Stourbridge, affording a direct communication with the Birmingham and Dudley Railway from Stourbridge to Birmingham. The whole of the line from Tipton within five miles of Wolverhampton, to Charlbury in Oxfordshire—a distance of 90 miles—was at this time in the hands of the contractors. The trial shafts of the tunnels had been sunk, and the viaducts at Holbrook and Stourbridge were shortly to be begun. The Great Western Company, who had subscribed £750,000, agreed to lease the line and to guarantee 3½ per cent. on £1,500,000 capital, subject to completion as a double line of broad gauge railway, with additional rails to provide for narrow gauge traffic north of Worcester, as prescribed by Parliament.

Photo] [*G. M. Perkins.*

KIDDERMINSTER STATION: GREAT WESTERN RAILWAY.

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Photo] [*F. E. Mackay.*

LONDON AND SOUTH WESTERN RAILWAY:
North Devon Corridor Luncheon Car Express.
4-4-0 Engine No. 466 (with Steam Dryer, Walschaert Valve Gear, etc.)

The Division of Railway Receipts.

By a NORTHERN RAILWAY RATES CLERK.

[*Concluding*].

IN the short contribution published in the December (1912) RAILWAY MAGAZINE I made it clear that, notwithstanding the complex and varied character of the instances in which goods and minerals are conveyed over the lines of two or more railways, provision has been made, by comparatively simple arrangements, for an equitable distribution of the receipts accruing from the carriage of such through traffic. While of a sufficiently comprehensive kind to cover a very great portion of interchanged goods, the method indicated is not, however, exhaustive enough to satisfy all demands, and a little further explanation is needed to deal with additional points of interest and with supplementary arrangements of a more or less exceptional character.

It will be remembered that in apportioning the receipts on a consignment carried over more than one railway, the Clearing House first deducts certain fixed amounts as terminals—"carted," "not carted," or "mineral" according to the nature of the services rendered—and credits the forwarding and receiving companies with these sums, the remainder being divided on a mileage basis, each of the carrying companies receiving a share in proportion to the distance carried over its lines. But there are a number of cases in which a railway company may fairly urge that for more reasons than one this is not quite sufficient. For example, there are several instances in the country where short sections of line have involved exceptionally costly construction, and companies owning these sections reasonably claim that they are entitled to consideration for their heavy outlay.

The Severn Tunnel on the Great Western, the Talerddig Cutting on the Cambrian, and the Forth Bridge on the North British may be mentioned as cases in point. By Act of Parliament, the companies concerned are empowered to make additional charges for traffic conveyed over the short sections named. The actual length of the Severn Tunnel is slightly more than 4¼ miles, but the Great Western have the right to charge

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as if the distance were 12 miles. Talerddig Cutting lies between Carno and Llanbrynmair, on the Cambrian main line, and, although the length of railway between the two stations is 5½ miles, the company are authorised to charge on double that distance, that is to say, as for 11 miles; and in the case of the Forth Bridge, the North British Railway may charge as for 19 miles more than the actual distance. In order that these railways may receive the increased amounts to which they are entitled, the lengthened mileages are taken into account when the rates are determined, and in dividing the takings the Clearing House calculates upon similarly increased distances.

It is, of course, unnecessary to explain that the cost of maintaining cartage staffs in London is considerably greater than at country stations. Accordingly, the London companies claim to be credited with higher amounts as "carted" terminals on traffic collected and delivered by their teams in the Metropolis, and correspondingly increased amounts are added in compiling the rates with London stations. Moreover, certain services not provided for in the ordinary rates charged, are frequently rendered by forwarding companies, or, if the rate includes such service, it is necessary to specially distinguish the traffic in the advices to the Clearing House, in order that the company performing the work may receive the payment to which it is entitled. As an illustration, it may be stated that it is usual for a railway forwarding round timber to undertake the loading, so as to ensure a safe transit for cumbrous and awkward material, but the unloading may very well be left to the consignees. The rates charged are, therefore, inclusive of the one service, but exclusive of the other, and the clearing House, being notified that a rate of this kind is charged, credits the loading company accordingly. In cases also where a railway provides wagons for minerals commonly carried in traders' trucks, a higher rate is charged, and the additional amount representing "wagon hire" is placed to the credit of the wagon-owning company.

Difficulties occasionally arise, and probably such difficulties have latterly become more numerous, in regard to the charges on traffic received at and forwarded from private sidings, that is sidings belonging to or rented by private persons and firms, and set apart for their exclusive accommodation. It is asked whether the trader is reasonably entitled to lower rates than are charged to the company's station, in consideration of the fact that wagons are loaded and unloaded upon his own premises instead of upon the premises of the railway, and, if so, what is the extent of the reduction to be made? At first sight it would appear that something is due to the trader who happens to possess a siding of his own, but reflection will show so many issues are involved that the matter is by no means as simple as it seems. Indeed, the circumstances at different places are so widely distinct that it is not possible to lay down rules which are universally applicable.

There may be cases in which the existence of a private siding is an advantage to both the trader and the railway, where rates should be reduced and receipts diminished accordingly; but, on the other hand, how many cases are there where a private siding is, from the railway company's standpoint, a hindrance rather than a help involving both inconvenience and expense? In the ordinary course of things, a trader forwarding or receiving traffic which it is not usual for the company to cart would convey it himself to or from the station, while the trader, having his own siding, requires his goods to be taken from or delivered at his own door regardless of the cost to the company. This work necessitates shunting, and often additional haulage. In fact, the question may well be raised whether extra services performed by companies in connection with the sidings do not more than compensate for any advantage which may be said to be gained by them by reason of exemption from loading and unloading the trucks. The problem is a perplexing one, and is suggestive of others which it is the duty of those responsible for the arrangement of railway rates and charges to endeavour to solve.

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London and South Western Railway.

ELECTRIFICATION OF SUBURBAN SYSTEM.

IT is well known that the London and South Western Company have been seriously considering the advisability of electrifying their suburban lines (which are shown by the thick black lines on the appended sketch map), and we are now in a position to announce that the directors have definitely decided to make a beginning by electrifying the circular route from Waterloo *viâ* Wimbledon, Kingston, Twickenham and Richmond, back to Waterloo again, and also the connecting link with the existing electric line between East Putney and Wimbledon. This portion involves the conversion of 73 miles of single track. The other portions of the scheme will follow in due course, involving the conversion of a further 73 miles of single track; but, having regard to the magnitude of the work, it will obviously be some little time before these further extensions can be put in hand.

In view of the controversy as to the most suitable system of electric traction for railway electrification, it is interesting to observe that the South Western Company has decided to adopt the direct-current third-rail system, using 600 volts on the third rail. This system has been in operation for upwards of twenty years, and its employment on the Lancashire and Yorkshire and North Eastern Railways in this country, and on the New York Central, Pennsylvania, Long Island, and the West Jersey and Seashore Railways in the United States, has been attended with complete success. The directors were also largely influenced by the fact that this system is used on the London electric lines, including the District, whose trains already run to Richmond and Wimbledon over the South Western metals, the convenience of being able, if necessary, to run through trains over the different lines being regarded as important. The South Western Company, feeling that a more reliable and efficient service is likely to result from having its own power supply, propose to establish a power house, with a capacity of 25,000 kilowatts. Sub-stations will be provided on the first stage of the work at Clapham Junction, Raynes Park, Barnes, Twickenham and Kingston, and the existing generating station at Waterloo will form another sub-station.

Three-phase electrical energy will be transmitted from the power-house to the sub-stations, where the current will be transformed to the required voltage, and rotary converters will be provided for converting the three-phase current into direct current at 600 volts, at which pressure it will be fed to the third rail. The current will return through the track rails, which will be bonded at the joints by means of copper wire beneath the fish plates. The trains will obtain current from the third rail by means of contact shoes fitted to the bogies. It has been decided to have two classes only on the electric trains, namely, first and third, but at the same time to adhere to the compartment system in preference to the open coach, as used on the Metropolitan and District Railways. We understand that the immediate proposals provide for 6 trains per hour in each direction on the more important routes, and that throughout the

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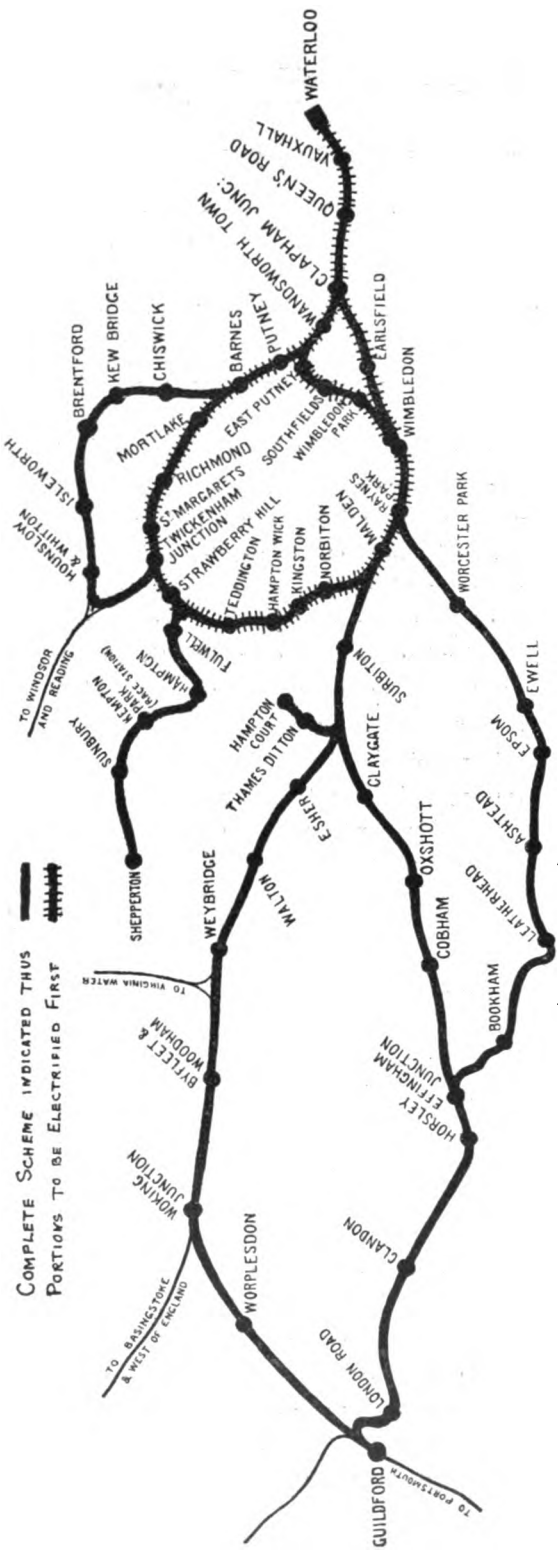

LONDON AND SOUTH WESTERN RAILWAY: SUBURBAN LINES TO BE ELECTRIFIED.

day electric trains will leave Waterloo at an average interval of three minutes.

Although forming no portion of the electrification scheme, reference should be made to several other important engineering works which the company have in hand. The rebuilding of Waterloo Station is now being pushed forward as rapidly as possible, and when completed the station will form a suitable terminus to one of the most progressive railway systems in the country. As regards convenience from the passengers' point of view, and facilities for handling the enormous increase in traffic which is anticipated as a result of electrification, the new structure will leave nothing to be desired. A widening of the railway on the viaduct over the Nine Elms goods yard, between Vauxhall and Queen's Road, will also be taken in hand. At present there are only six lines at this point, while elsewhere between Waterloo and Clapham Junction eight tracks have been provided. At Hampton Court Junction—where the lines for Cobham and Guildford and Hampton Court, respectively, diverge from the main line—the trains for Hampton Court have at the present time to cross on the level. This process involves delay, and a fly-over junction with the Hampton Court branch is therefore to be provided.

Sir Alexander Kennedy and his partners are the Company's consulting engineers for the electrification, but the electrical work generally will be in charge of the Company's Electrical Engineer, Mr. Herbert Jones, who has recently returned from America, where he has made a close investigation of the electric traction work carried out in the United States. The work on the permanent way will be under the direction of the Company's Chief Resident Engineer, Mr. J. W. Jacomb Hood, and the new rolling stock required for the electrification will be designed by the Company's Carriage and Wagon Superintendent, Mr. S. Warner, and constructed in their Eastleigh Works, the entire scheme being, of course, under the supervision of the General Manager, Mr. H. A. Walker.

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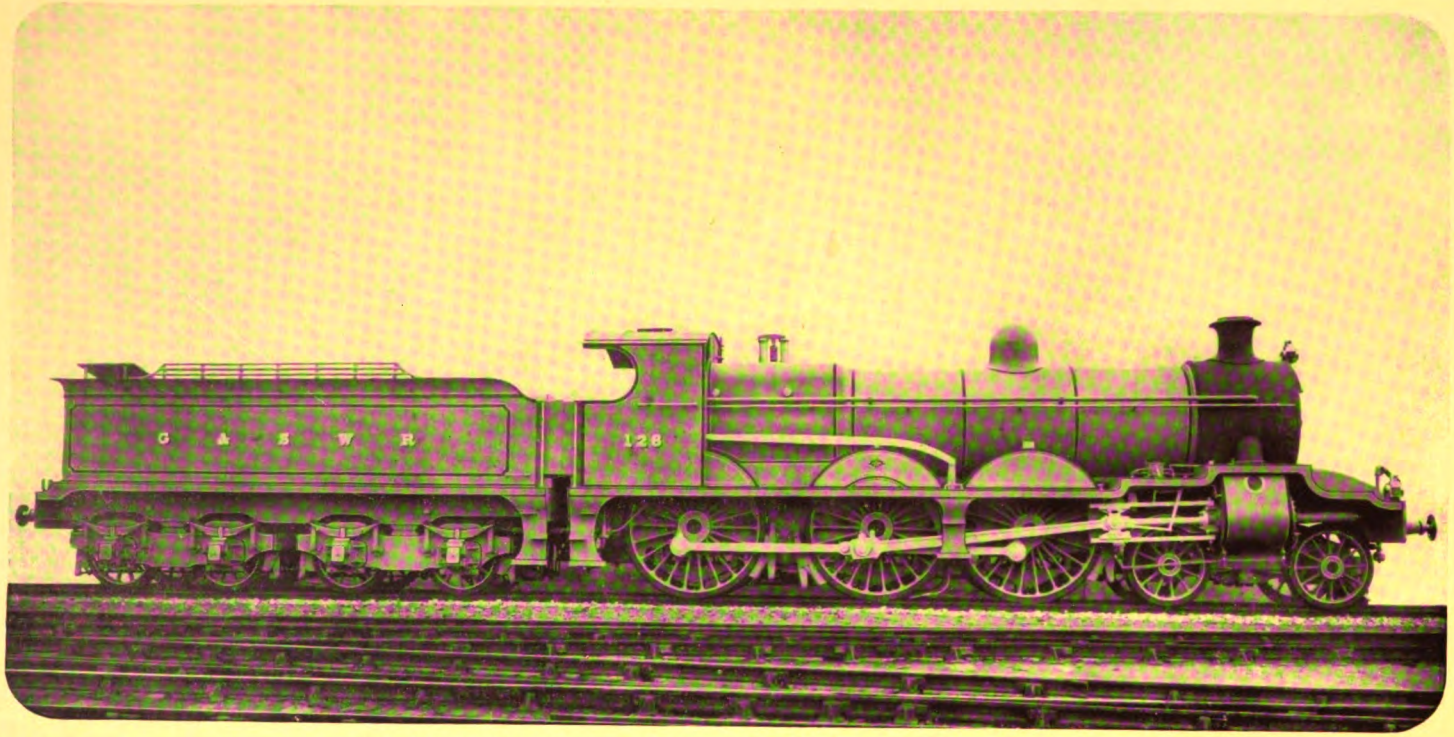

GLASGOW & SOUTH WESTERN RAILWAY.

4-6-0 Express Locomotive, fitted with Schmidt Superheater, Piston Valves, etc.

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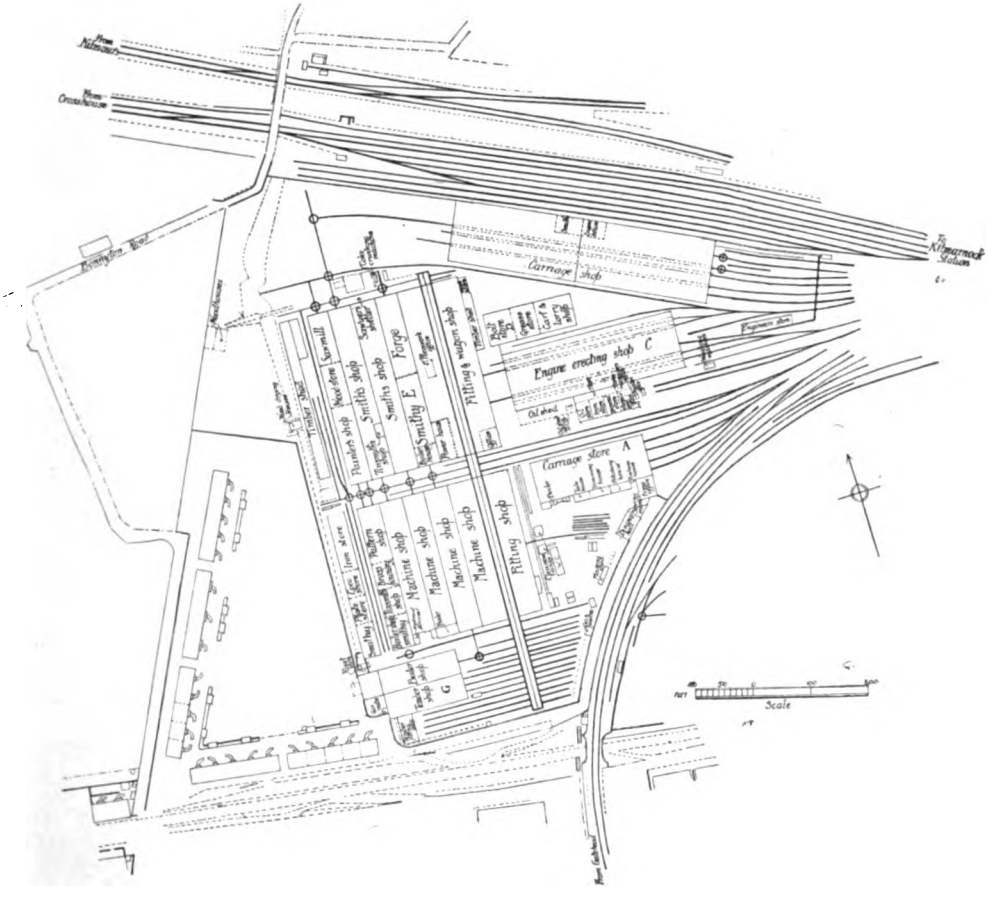
The Kilmarnock Works of the Glasgow and South Western Railway.

By J. F. GAIRNS.

ALTHOUGH the Glasgow and South Western Railway does not rank among the biggest railways in Great Britain, it is legitimately included in the "great" systems of the United Kingdom, whether in respect of mileage, traffic, train services and rolling stock, or in reference to capital value and magnitude of annual receipts and expenditure. Hence we find at Kilmarnock a locomotive, carriage and wagon repairing and building establishment which gives employment to nearly 1,000 men, boys, and a few women, with a further 270 employés engaged at the auxiliary wagon works at Barassie, eight miles away. Yet, even with such resources, it is frequently necessary to place orders for new locomotives and rolling stock with outside firms, the capacity of the Kilmarnock Works being sufficient to admit only of a limited amount of new construction in addition to current maintenance work. Indeed, with about 400 locomotives, 1,400 passenger train vehicles, and 18,000 goods vehicles of various kinds to be maintained, and a certain amount of general work carried out for the other departments, Mr. Peter Drummond and his assistants have enough to do to keep level with requirements. Therefore, one does not see at Kilmarnock a series



PLAN OF KILMARNOCK WORKS.

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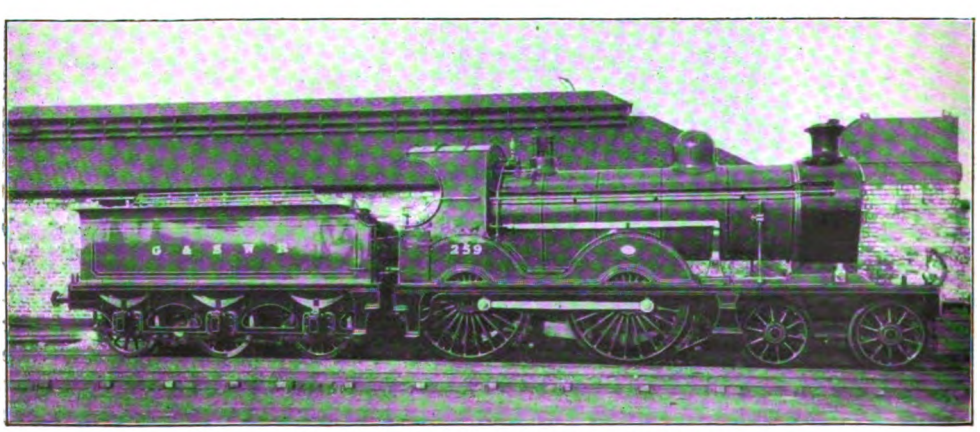
of new locomotives of more or less notable design in various stages of construction, nor rows of new carriages and wagons nearing completion. Instead, there is a somewhat miscellaneous group of buildings devoted mainly to repairs and re-building, although a limited amount of new construction is also undertaken every year, the whole giving a suggestion of steady, unobtrusive work minus the glamour of more ambitious and elaborate establishments devoted largely to the building of new engines and vehicles as well as current repairs.

The Kilmarnock works are located in a somewhat restricted area, which is sandwiched between the original main line to Glasgow *viâ* Dalry and the curving branch towards Troon and Ayr. Almost every square yard of space available is utilised. Scattered about are several large buildings or groups of buildings, with numerous smaller structures, the intervening spaces having railway tracks or sidings serving outdoor requirements. As the works have developed from the original establishment erected in 1858—and most of the original buildings still do duty—it follows that the various departments are situate where convenient rather than where modern principles of shop lay-out would require. In this respect, however, Kilmarnock is in the same position as most of the older railway works of corresponding capacity; and one finds a large number of relatively old machine tools still rendering excellent service side by side with the more modern machines introduced in later years. Despite these drawbacks, Kilmarnock is able to show a good record of maintenance efficiency, and does its share in enabling the Glasgow and South Western Railway Company to realise satisfactory returns to its shareholders, while the economic aspects of repair and construction undertaken at Kilmarnock compare favourably with the results obtained by newer and more up-to-date establishments.

Mr. Peter Drummond—to whom I am indebted for facilities extended to me when inspecting the works—is now in charge at Kilmarnock, having, a few months ago, succeeded Mr. James Manson on his retirement after 20 years continuous service. Mr. D. Smith, late Chief Draughtsman at Inverness, is in charge of the drawing office, Mr. Peter Howie having control of the clerical staff, while Mr. Kenneth Cullen is chief of the accountants' department. Mr. Thomson, late Chief Draughtsman, is Works Manager, ably seconded by Mr. Hart as Assistant Works Manager at Kilmarnock, and by Mr. McAlpine at Barassie. The plan reproduced on page 25 indicates the main features of the Kilmarnock works. Principal entrance is obtained by means of a private road following the curve of the Ayr branch towards Kilmarnock station from Bonnyton Road, whence access is given by an inclined roadway for vehicles and by steps from that thoroughfare alongside the railway bridge. Workmen enter through the time office, and thence proceed to the various shops.

The chief offices are located in a somewhat antiquated building near erecting shop C, the structure suggesting an attempt at mediæval architecture in grey stone. As indicated, the ground floor is devoted to various stores and offices, while the upper floors contain the offices of the locomotive



4-4-0 LOCOMOTIVE CONSTRUCTED AT KILMARNOCK WORKS.

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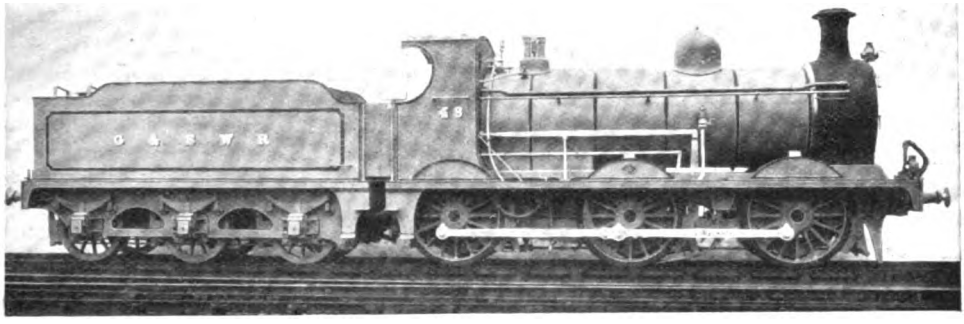

STANDARD GOODS ENGINE.

department and the drawing office. The works manager's office is in one corner of the large works building marked E. In view of the somewhat miscellaneous arrangemet followed, it will be advisable to consider first the buildings of largest size, dealing with others as they call for notice. Principal interest, therefore, attaches to buildings E and F, each consisting of one bay 110 ft. wide and four 40 ft. bays. A steam traverser runs along the centre of both these wide bays, and serves 50 cross lines under cover, in addition to outdoor tracks. The complete travel of the traverser is about 700 ft. It provides a principal means of transferring engines and vehicles from one section to another, as also for conveying wheels and heavy parts. Railway tracks connected by turn tables supply further means of transfer. Two of the cross lines in building E and one in F connect, through openings in the walls, with outside lines.

Building E is the largest under one roof, its length being 310 ft., as compared with 250 ft. in the case of F. The latter is, however, more important from the point of view of the machinery installed. East of the traverser pit, at the north end of the wide bay, is the wheel-fitting department, with a 250-ton hydraulic wheel press for fitting axles, the remaining space being used for engine and boiler repairs and for general purposes. West of the traverser pit, is the heavy tool shop, where a number of wheel lathes and other machines are placed. Inside the south wall is a set of large vertical plate rolls by J. Shanks & Co., of Johnstone. A series of drilling machines include a duplex double-head design by Fairbairn, Naylor, MacPherson & Co., a double-head tube plate drilling machine by Campbells & Hunter, a Shanks axle-box or plate planing machine having a 23 ft. bed, and a large G. & A. Harvey radial arm drill. Beyond is a big wheel lathe by MacLea & March, and among other machines are a double-head cylinder planer by Sharp, Stewart & Co., a Fairbairn & Kennedy axle and wheel lathe, and a Sharp, Stewart wheel lathe. A new 15-ton overhead electric crane by Marshall, Fleming & Co., travels the whole length of the machine bay west of the traverser pit, serving all these machines.

Next to the wide bay is the first of the three bays constituting the machine shops. Each has a railway track down the centre, with machines on either side; and it will be convenient to review their contents by traversing the east side from north to south, returning on the west side, the three machine bays being taken in order, beginning with that nearest the wide bay. In machine shop A a facing lathe and a cylinder boring lathe by MacLea & March are first seen. Close to these are two horizontal drills specially designed for working between the spokes of wheels in order to drill holes in the tyres. Several facing, boring, and ordinary lathes are placed along this side, together with a powerful axle lathe by Sharp, Stewart & Co. A Harvey slotting machine, an 8-tool planer by Shanks & Co., a large modern slotting machine by G. & A. Harvey, and a somewhat similar tool by Loudon Bros., may be specially mentioned. Near the end is a group of small lathes for valve rods and the like. An enclosure reserved for brasswork contains six brass finishers' lathes and a Whitworth milling machine, the latter being the only one of the class at present installed at Kilmarnock. At the end of the shop a few benches are reserved for fitting up injectors, ejectors, and Westinghouse air-pumps.

Alongside these benches, and against the

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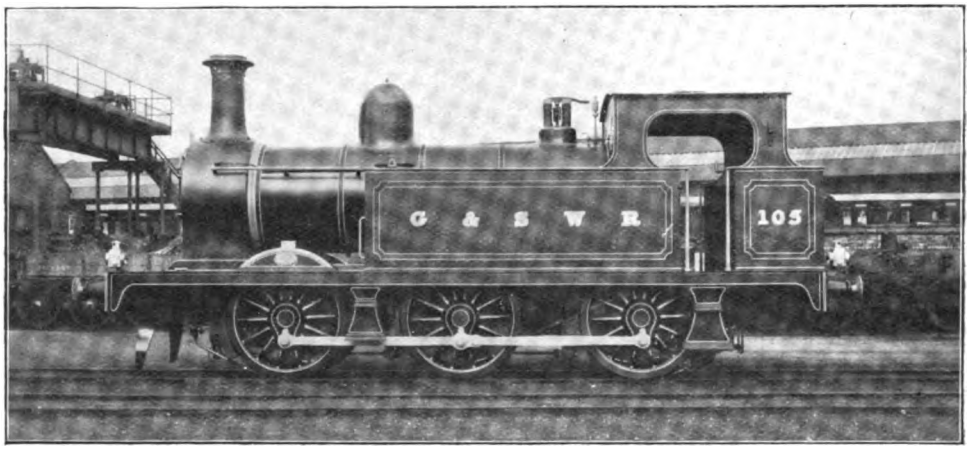
end wall, is a platform carrying a two-cylinder Tangye steam engine driving the shafting of this bay, and, by means of a rope drive through an opening in the division wall, that of machine bay B. In each case a main shaft extends longitudinally along the centre of the bay, with belting to auxiliary main shafts serving groups of machines. Close to the engine platform is a large double-headed planing machine by Shanks. A group of machines adjacent includes three Whitworth radial drills, and near the centre is a group of jobbing lathes of various types. Further are some larger machines, including a Shanks shaping machine with one tool head and two work tables, a tyre boring machine by MacLea & March, a wheel lathe for medium diameters by Sharp, Stewart & Co., and a Shanks double-headed wheel lathe and boring machine.

equipped with a large grinding and polishing stone, buffing wheel, and polishing mops. Near the division wall on the west side are two screwing machines, a saw for cutting stay rods, screw cutting machines for making stay bolts, other screw cutting appliances, and a few shaping and planing machines of older design. The remaining space along this side is devoted almost exclusively to lathes and boring machines of various types, including one specially designed for turning piston rings, and two large wheel lathes.

Machine bay C is largely devoted to special machines and operations. It is supplied at the further end with motive power by a wall engine of an early type. Inside the north wall on the east side is a 6-spindle tapping machine, and near by are several special lathes, one being equipped with a variable belt drive by J. Lang & Co.,



SIX-COUPLED TANK ENGINE BUILT AT KILMARNOCK WORKS.

The north end of Machine Shop B contains, on the east side, a group of small lathes, largely by Smith & Coventry, one or two being of turret types, two large lathes, a wagon wheel and journal lathe, a single-headed wheel lathe, and a slotting machine by MacLea & March, together with fans for supplying air to the forges in the smithy. Beyond the cross passage, the space is largely devoted to drilling machines of various kinds, including a large Whitworth radial drill, a Harvey duplex drill and four large machines by MacLea & March. This bay is slightly shorter than machine shop A, the end being partitioned off to serve as a grinding department. The rope drive from the engine in the next bay passes behind this division, and the remaining space is

of Johnstone. A Smith & Coventry turret stud lathe and a corresponding machine with two turrets, a brass turning lathe by the same firm, a powerful machine for tapping big nuts, and a double spindle boring machine for wagon bushes by Fairbairn, Kennedy & Naylor, may also be mentioned. Beyond the main cross passage is a vertical machine by Hulse & Co. for buffing out holes to true circles after case hardening. On this side the remaining space is devoted to fitters' benches. Opposite are several grindstones, an emery wheel, a Hartness turret lathe by Jones & Lamson, two old morticing machines, and a hydraulic press for piecing tubes. Beyond the halfway division are two machines for boring tube ends to receive extension pieces, another Shanks shaping

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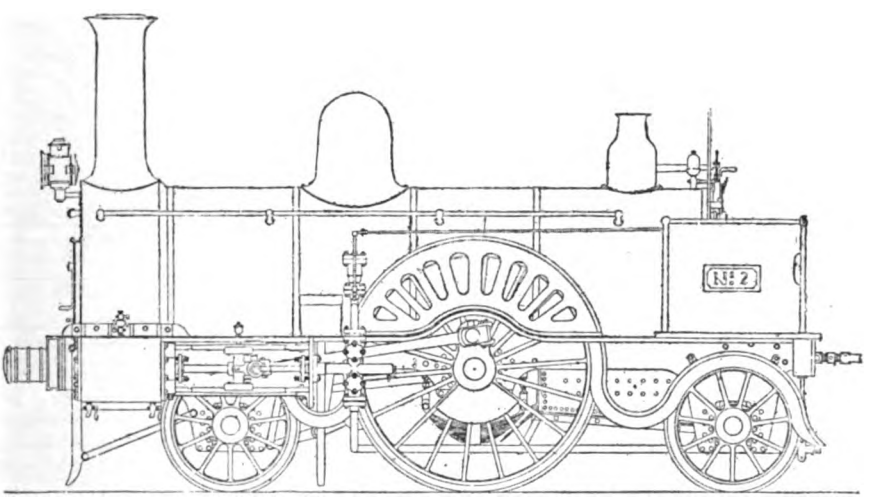
machine with one head and two tables, a machine for cutting ferrules, a heavy screwing machine by Smith, Peacock & Tenant, a hydraulic press for shaping ferrules, a slotting machine by W. Muir & Co., of Manchester, two new screw-cutting lathes with special boxed-in gears by J. Lang & Sons, a wheel lathe and other tools.

The boilers supplying the two machine shop engines are erected outside the south wall of machine shop B, while beyond the end wall is a hydraulic accumulator, fitted with steam pumps. The boiler smithy and machine shop contains a large punch and shears by Fairbairn, Kennedy & Naylor, having its own steam engine, together with drills, small punches and shears, a saw for cutting hot iron, and a furnace for flanging plates. A division is devoted to splashers, ashpans, and chimneys. The end bay of this building is completed by the brass foundry, coppersmiths' shop, and pattern shop.

In building E the west side of the main bay is devoted to new wagon building and fitting. Cross lines for wagons are available half-way along, and the remainder of the space is devoted to bench work, and the markers-off for woodwork. An overhead hand crane travels the whole length of this section. Crossing the traverser pit, three distinct sections are seen. At the further end is the sawmill, with a collection of light woodworking machines, and horizontal steam engines supplying motive power. Among the tools here installed are band and circular saws, drills, slotting and mortice machines, a McDowell planing machine, a tennoning machine for heavy wagon timbers, by J. Robinson & Co., of Rochdale, a double-spindle moulding machine, and an underframe planing machine, by Western & Co., of Derby, adapted for planing four sides simultaneously. Beyond is the locomotive fitting and finishing shop for rods, motion, valve gear, and general mechanism. Here bench work only is undertaken, and no machinery is installed. At the south end is an enclosed power station for supplying electric current for lighting the shops and offices and for operating cranes in the erecting shop. A two-cylinder compound enclosed high speed engine, by the Anderston Foundry Co., of Glasgow, drives a dynamo by Messrs. Selby, Bigge & Co., of Newcastle.

Beyond the partition wall the first 40 ft. bay contains, at one end, the boiler house for the adjacent power station, with two locomotive boilers. Then comes the small smithy and forge. A 5-cwt. steam hammer serves the former, while the latter has two steam hammers—20-cwt. and 15-cwt. At the further end an old bolt heading machine still does good service, though to meet present requirements it has had to be strengthened. The next bay is the heavy smithy, and here five steam hammers and two Olivers are in use. At the south end is a furnace for shrinking on engine wheel tyres. A Royce electric jib crane is there installed. The fourth bay is used partly as a smithy. There is also an enclosure devoted to the tinsmith, with a tyre stove, iron racks, anvils, furnaces, and spring-making and testing machines adjacent. Power is provided



THE FIRST ENGINE BUILT (1857) AT KILMARNOCK WORKS.

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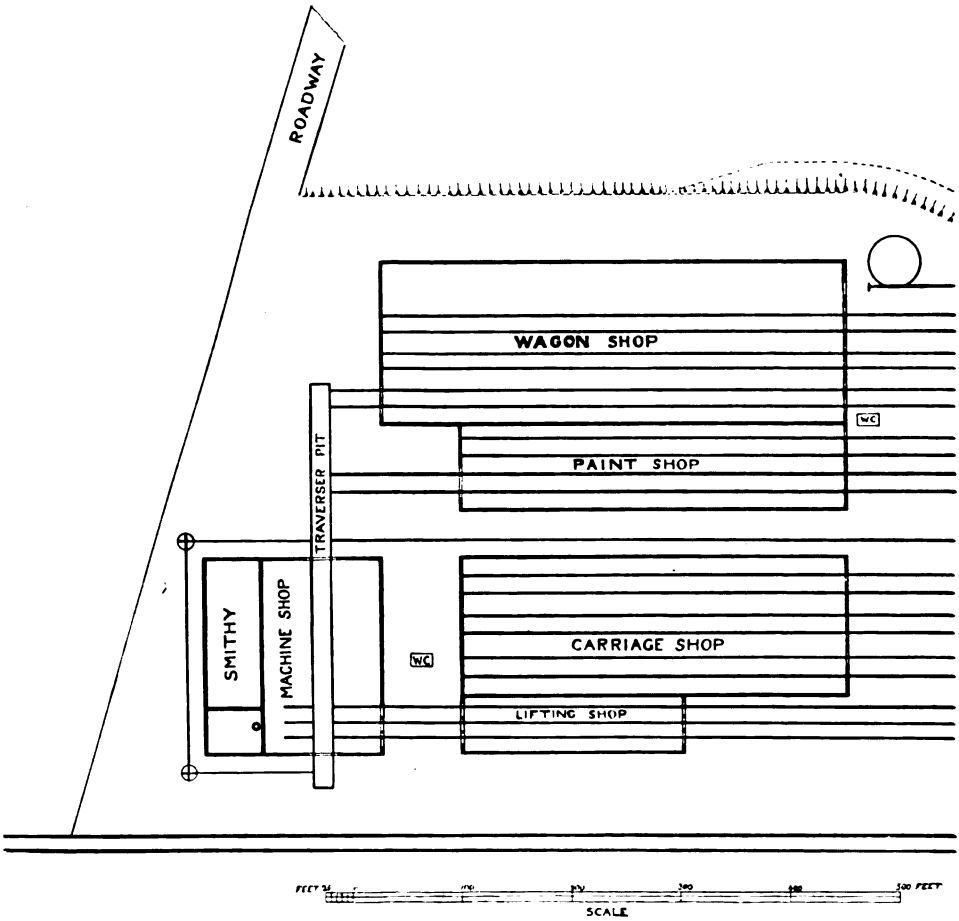
by a horizontal engine of unusual type. The last bay is devoted to miscellaneous purposes. At one end is the tube store; then comes a wood store, while the northern portion forms the heavy sawmill. A multiple saw for cutting up large baulks of timber and a circular saw with a 60 ft. table may be specially mentioned in the equipment.

The boiler and tender shop at the south end of the works (building G) next calls for attention. Its main portion is 140 ft. long, in two sections each 45 ft. wide. The boiler section contains a hydraulic riveting machine, having its own crane and pit, plate bending rolls, a machine for tapping holes in fireboxes, and a Whitworth radial drill. Two overhead cranes serve the tender shop, and a small shop opening therefrom is devoted to fitting work. The erecting shop is a newer building, 300 ft. long and 100 ft. wide. It contains two bays, each served by two 35-ton Craven overhead electric cranes. Two tracks in each division enable about 40 engines to be dealt with simultaneously, while there is ample space for benches and all incidental work. At one corner is an 8-table Pooley weighing machine.

Divided midway, the carriage shop is a fine building 450 ft. long. It is well lighted and laid out, and a comprehensive series of departments are included under its roof. Along the north side, at the west end, are the carriage fitters. Next comes a section devoted to the manufacture of window frames, picture frames, and other details. Several small enclosed shops are partitioned off. First among them is the carriage smithy, containing forges, anvils, and a steam hammer. Alongside is the carriage brass foundry. Here machine moulding is



PLAN OF THE WAGON WORKS AT BARASSIE.

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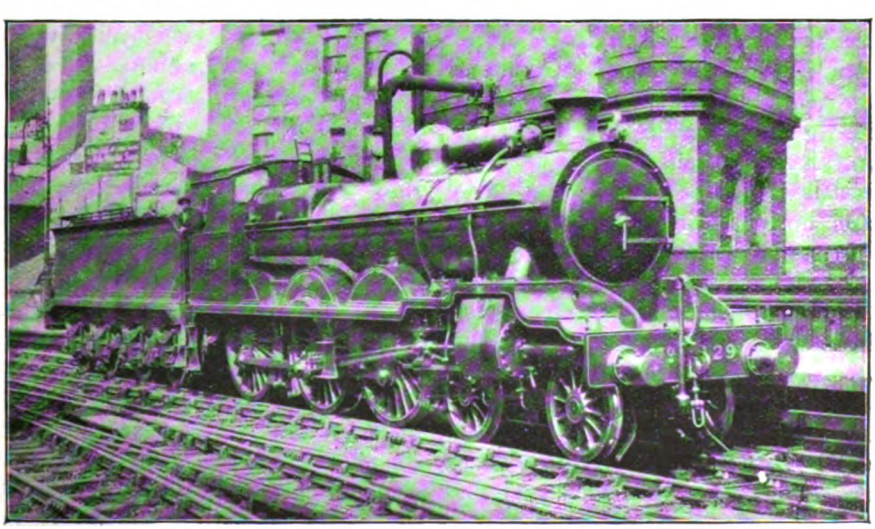
adopted for making bushes and other standard parts. Next is the engine room, containing a single-cylinder Tangye steam engine, driving a fan for the smithy, and supplying power for machines in the adjacent woodworking department. The latter, open to the main building, contains a Robinson planing machine with a 60 ft. bed, circular and band saws and drills. Towards the east end there is a section for cleaning battery cells as used in train lighting, also a charging room containing two suspended dynamos of carriage type driven by belting from the shop shafting. On this side a hydraulic lift for raising carriage bodies completes the equipment. Rail communication with outside tracks is effected as shown on the accompanying plan.

Along the centre of the building are three continuous lines. The west end is partly reserved for wheels and axles, the remainder being available for carriage repairs and erecting, with benches for incidental work along the south side. Among miscellaneous departments and buildings, it may be stated that to the left of the time office on entering is the sewing room, accommodating a staff of girls engaged in making carriage trimmings. Next is a dining hall for the men who stay on the premises for meals. A hot plate is available for warming food, but no other special arrangements are made. In the yard near by are boiling tanks for cleaning motion and other parts from grease.

A boiler in the rear of building F serves a group of Westinghouse pumps which supply compressed air for pneumatic tools. Along the west boundary are the rivet store, locomotive and various other stores, some closed (for engine details), others open (for iron plates, bars, rods, angle irons, and timber). A wood-drying house and special timber shed are also established. Between building E and the carriage shop is a bolt store, grease store and cartwright's shop, where the vans and lorries in railway service are constructed and repaired. Connected therewith is a small paint shop. Returning towards the time office is a row of small departments, alongside the carriage store and paint shop. In the French-polishing department a number of girls are employed upon the special carriage decorations. The tube house contains a power-driven rumbler for cleaning tubes. A number of other small shops and departments are scattered about the works, but these need not be specially described.

The works at Barassie are devoted to carriage and wagon repairs. Equipment consists of wheel lathes, screwing and other machines. Two 10-ton overhead electric cranes, by Marshall, Fleming & Jack, serve the machine and van lifting shops respectively. Hydraulic lifts in the carriage repairing shops are supplied by a Fielding & Platt accumulator and duplex pumps. The electric station is equipped with a similar plant to that at Kilmarnock, steam being supplied by two Babcock water-tube boilers. Finished parts for both carriages and wagons are supplied from Kilmarnock as required. Arc and incandescent electric lamps provide illumination throughout the works.



Photo] [Lieut. B. D. Holberton, R.N.

GLASGOW AND SOUTH WESTERN RAILWAY:
129, fitted with Feed Water Heating Apparatus and Schmidt Superheater.

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Leaves from the Log of a Locomotive Engineer [No. IV.]

By ROBERT WEATHERBURN.

PERILOUS POSITION UNDER AN ENGINE.

ONE little incident among many which occurred to me at this time may be worth the telling, as it again shows how narrow is the margin between life and death.

The Kirtley-designed engines of the Midland Railway delivered at that time by Kitson & Company were fitted with inside frames, and in order to get to the axle boxes it was necessary to go underneath. On one of my journeys from Leeds to Derby with an engine of this type—the engine being placed next to the guard's van for convenience in shunting as the train was a slow pick up one—we, in due course, arrived at Swinton Junction, where the driver had to stop in order to leave or pick up some wagons. It was a long train, and the night was dark. The guard, who knew I wanted to examine the bearings, told me that this was my opportunity, as he had to do some shunting, and he assured me I could go underneath undisturbed, as he would take care to give me notice when the train was coupled up. With this assurance, lamp in hand, I went underneath to replenish, if need be, the inside bearings. To reach the bearing trimmings, I had to get between the driving axle and the fire-box as the valve gear was up, the connecting rods being alone disconnected. While doing my work, I sat on the ashpan damper, which was wide open. I had heard the shunting going on for some little time, but relying on the guard's assurance, had no fear, although, standing as we were on the main line, the position was not a reassuring one, when suddenly I heard the bump, bump, bump of the train wagons striking the engine buffers, and the engine moved back a few inches.

To my horror I heard the "right away" touch of the whistle given. The train was in motion! Dropping the lamp, I clutched desperately with extended hands at each inside frame. The eccentrics and cranks were revolving slowly close to my chest! I shouted, but my position and the noise around prevented my shouts from being heard. The guard, however, standing where he had coupled up some distance away, waiting to jump on his van, fortunately caught sight of my over-turned lamp still alight between the rails, and realised the mistake he had made. In a moment he turned the red lamp, signalling them to stop. Again, providentially, the driver or fireman was looking back to see if the train was all right, and observing the red light immediately stopped. It would be impossible to convey to even those initiated in railway work the peril of my position—seated on the damper, with my knees drawn up to clear the ground, holding on by each hand to the inside frames, flattening myself against the firebox, to avoid the revolving cranks and eccentrics, knowing full well that such a strained position could only be maintained for a minute or two before certain death followed. How I scrambled out from between the wheels I cannot tell. But even then I thought of my lamp, and having recovered it, joined the guard—poor fellow—who really seemed more put out than myself.

The reader may have recognised that in writing thus far, I have, desired, without too much divergence, to bring into notice, and in some instances to sketch, very imperfectly, a few of those characters who have struck me as worthy of a higher tribute than circumstances have permitted. In the

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engineering profession, as in all others, it too often occurs that the light flung upon well-known names blinds us to the recognition of others, who, at times in the bye-walks of the profession, have done much more in proportion. My pleasure and reward will, however, be ample if I succeed in awakening an interest in men who have done foundation work for others to build upon, and to secure the credit, or if I have been able to renew an interest in those who bulked large in their day, but whose qualities and merits by change and succession have been to a great extent obliterated. Hence my mention of Mr. J. Stephenson, of York, and John Kendal of Cardiff.

My Experience on the Brighton Railway.

And now a brief mention of Mr. William Stroudly, the once well-known locomotive Superintendent of the London, Brighton and South Coast Railway. It was my good fortune, after experience in the North of England and a somewhat prolonged absence from English railways, to be sent to Brighton with locomotives designed by that engineer. The diversity of practice on English railways was at that time unmarked by any particular feature. Differences were principally confined to dimensions or to trifling details. The old beaten track was sedulously followed with painful fidelity, until Stroudly, virtually unknown until his appointment on the London, Brighton and South Coast Railway, came into notice. He had the advantage over the majority of locomotive superintendents in being a thoroughly trained mechanic and engine driver. Familiar with past and contemporary practice, and gifted with analytical powers of a high order, he was able to appraise the value of any particular feature or design. Original in many things, he was not too proud to glean where others had failed to reap. Possessing the courage of deviation, his engines marked a sudden departure from prescribed practice.

MR. W. STROUDLY, AT AN EARLIER PERIOD LOCOMOTIVE AND CARRIAGE SUPERINTENDENT OF THE LONDON, BRIGHTON AND SOUTH COAST COMPANY: ACKNOWLEDGED TO HAVE BEEN ONE OF THE MOST REMARKABLE RAILWAY ENGINEERS OF HIS TIME.

Only a man of the highest courage could have succeeded at a time when the whole list of engineer superintendents were harnessed to ideas sanctified by long practice; but he did succeed, although because of his self-assurance, which bordered pugnacity, he was never a favourite. Many divergent opinions are held, but it may be truthfully asserted that hardly a first-class type of locomotive is to be found which does not possess some feature of Stroudlyism. Mr. Dugald Drummond, the late Locomotive Superintendent of the London and South Western Railway, was at that time his Works Manager, and so thorough a mechanic as he would never have continued the Stroudly practice in general and detail features unless there were excellent reasons for their retention. My experience with Mr. Stroudly was of short duration, but, like others who had the privilege of his acquaintance, it was, from an educational point of view, most beneficial. Never too proud was he to impart his reasons for each new departure, while in the majority of cases their very reasonableness carried conviction.

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Many who considered Stroudly a faddist copied him in practice. Even to the smallest detail deep thought underlay his work. He made the most scientific boiler of the day. I believe I am right in saying he was the first in the country to cast both cylinders in one piece. His pistons and rods were a complete deviation from acknowledged practice, his slide bars being protected and laid so as to force lineal directness. His connecting rods were a combination of marine practice and Berry's shape—lathed and machined from end to end, with hardly a touch of the file. His eccentrics were cast in pairs, and driven from the crank, while his system of balancing from the crank, heating the feed water by exhaust steam, clothing the firebox front and tender sides, providing inside bearings for all wheels, and underlying springs and cab protection for drivers, were one and all due to his initiative. Every feature—from wheel to chimney top, firebox door to duplicate gauge glasses, regulator, etc.—were marked departures. Not a rivet, not a bolt, escaped consideration as to position and shape in its strict economy and use as a part of a whole. He was also the inventor of the first practical railway ramp, without which no railway depôt, yard or break down van is nowadays complete. Although no longer, or rarely, seen, his speed indicator was a pretty and an effective contrivance.

MR. DUGALD DRUMMOND, LATE LOCOMOTIVE SUPERINTENDENT OF THE LONDON AND SOUTH WESTERN RAILWAY, AND FORMERLY WORKS MANAGER FOR MR. STROUDLY. THIS PORTRAIT IS REPRODUCED FROM A PHOTOGRAPH GIVEN TO MR. WEATHERBURN BY MR. DRUMMOND SHORTLY BEFORE HIS DEATH.

An Athlete in Mechanics.

It can simply be averred that with very ordinary supervision a Stroudly boiler is the nearest guarantee against accident provided. Stroudly not only knew what he wanted, but knew how it should be done, and no better proof of the excellence of his embodied ideas can be given than their endorsement and continuance on the London and South Western Railway by such an able man as Mr. Dugald Drummond. Everything had to be exactly fitted, with little or no allowance for initial play. That came soon enough. Hence his engines required greater care in breaking in for regular service. His locomotives were the production of an artist, an athlete in mechanics—no jingling rods, projecting rivets, bulging bolt heads. With him cleaning was made easy and a pleasure. It was naturally difficult to please him, and those firms that were favoured with his orders found to their cost that the slightest deviation was productive of trouble. In this connection I remember an incident of a diverting character which occurred when breaking in one of the new engines with which I had to do. The run was from Battersea to Brighton and back—the driver, one of the hardest working and quaintest individuals to be found, proud of being selected by his chief, and proportionately anxious to give satisfaction. No man could have done more, and yet misfortune followed his steps. It

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was no uncommon thing at that time, owing to traffic yard difficulties, to be sixteen or seventeen hours on duty, so that once out of limits of yards and signals, we made the best of our time.

On a particular day we could not get away to time, and at Brighton found ourselves foodless. Although it was difficult to leave the goods yard, I sent the fireman with half-a-crown to buy some bread and cheese, or anything he could find. He returned with a pound of cheese and one small loaf of bread. the last, he said, in the shop, and three of the largest Spanish onions. Immediately after we received the signal to go, and a more depressing night of wind and rain it would have been difficult to experience. After clearing "Three Bridges," all seeming favourable, it was arranged that I and the fireman should get something to eat whilst Jack looked after the engines and signals. Eating on an engine is by no means a gastronomic treat, particularly where the viands are of so simple a character. With a chunk of rough hewn loaf in one hand and a piece of cheese in the other, an appetite sharpened by long hours of abstention, the meal for my part was soon over, and I resumed my watch whilst the fireman, who, by the way, was a small and spare man, still vainly struggled to appease his most palpable hunger. At length he resumed the shovel, and I took the regulator from the driver in order to give him his turn. I heard the question, "Where's the bread, Tom? Where's the bread?" The look of the fireman was indescribable, and such as none but a Battersea-bred man can give as he said, "Bread's all eaten, Jack—plenty of cheese and onions." The tall, good-natured driver, after commending Tom's stomach and conscience to an especial care which need not be particularised, made the best of the situation. With a large onion between his thumb and forefinger and a piece of cheese wedged in the palm of the same hand, he seriously took to the task of supplying Nature's needs. The situation was comical, but it soon changed, for, as I leaned over the side of the cab, I smelt that something was running hot. In a moment I swung myself out on the footplate, and on arriving at the cylinder saw the piston rod blood red. I signalled and shouted to the driver to stop, which he did as soon as possible, but not before the piston rod had become like a red-hot bar moving in and out.

Gland spanners were got out, and arrangements made with the guard, while I underneath, and the driver on his knees on the footplate, together slacked the gland to liberate the ground ring, which was fitted in two halves. Every part was blazing hot as the result of the friction, and as fast as we took off nut glands and bushes, they were consigned to a bucket of water which was placed close to the leading wheel. Regardless of burning his fingers, and anxious to do his best, the good-natured driver forgot where the bucket had been placed, and the night being dark and stormy, the only light being shed by a hand lamp, he got one of his feet into the engine bucket when springing to the ground, and was jammed so fast that in his hobbling efforts to maintain his footing he rolled down the embankment with the pail still attached to his foot. Hearing something unusual, I crawled out, and found him endeavouring to free himself from his leg shackle. In spite of the bad weather and the vexation caused by the breakdown, the expression on his otherwise pleasant and honest face I shall never forget. Unable for a time to regain his feet, his cap lost, his beard soaked with grease and moisture, and his clumsy attempts to climb the embankment, banished all sense of discomfort from me, and I shrieked with laughter. But he took it all in good part; and years after, when the brown of his beard was flaked with white, seasons and weather having painted the "crows' feet," he came into my office in Kentish Town to remind me of our past experience, I recognised the good-natured fellow more by his smile than by anything else.

Although my experience on the London, Brighton and South Coast Railway Company was limited, it enabled me to make many valuable acquaintances independently of Mr. Stroudly. One of these was Mr. Dugald Drummond, a man of unquestioned ability and great energy. His staff, too, were composed of some remarkable characters, well known in their day, who happily linked the past traditions of the line with the then present. Among these were Mr. Richardson (the father of the present Mr. J. Richardson), who was then known as the "Duke of Albany," the Beau Brummel of the line; Mr. Trangmar, whose son I believe is now at New Cross, and Mr. Woodhead, of Brighton—all devoted to their chief.

[Mr. Weatherburn's fifth contribution will appear in the February RAILWAY MAGAZINE.]

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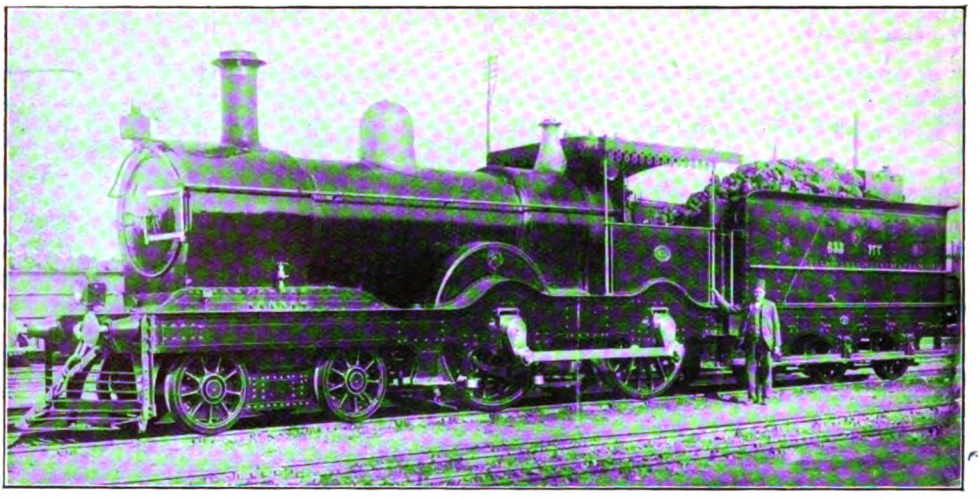

EGYPTIAN STATE RAILWAYS: STANDARD EXPRESS LOCOMOTIVE.

The Egyptian State Railways.

By H. C. WORTHAM.

RAILWAYS! Yes, there are railways in immemorial Egypt, owned by the State—an excellent example for our Oriental socialist of the blessings of his creed. We associate travel in Egypt with long days and moonlit nights spent upon the Nile; but your modern tourist usually goes up-river in the *train-de-luxe*, not in a dahabeyah. Egypt is as luxurious now as in the days of the Pharaohs, while even those mighty monarchs had no railway system, State-owned or otherwise. An inscrutable species is our tourist, but whatever he finds to complain of in our midst, it is not the State railways. At Alexandria, where he arrives, a special corridor train awaits him on the quay-side, with Cairo only three hours away. So he does not probably wait and visit the romantic city of Cleopatra and Anthony, the burial place of the great Alexander, and in the future to be distinguished as the northern terminus of the misnamed Cape to Cairo Railway. In half an hour he has left the Mediterranean behind him, and is running along the edge of the great Lake Mareotis. He soon enters the rich country of the delta that continues as far as Cairo. He will not admire the landscape; Lower Egypt is too rich to be picturesque. The beautiful wing-shaped sails of the Nile peleuccas on some canal will attract his attention, but there is little else to break the horizon. A few trees, an occasional sycamore or lebbek are all there is to see. Numerous villages, built of mud-bricks, are squat and unprepossessing. The beauties of Egypt are to be found in Cairo, and on the upper river, the delta being the land of work.

Never, surely, will the tourist have seen a more active countryside. Every field has its toilers, both men and beasts; and along the banks of the canals which border the line, a constant procession is visible of men, rather fat and big, riding donkeys, the usual way the male native, who objects to walking, has of getting about. The visitor will see, too, numbers of women who are carrying waterpots and other loads on the top of their heads, and innumerable children tending the uncouth buffaloes, without which the Egyptian peasant would be entirely at a loss. Sometimes one of these heavy animals, when it does not happen to be blindfolded at its treadmill task of the waterwheel, will take it into its head that the train is an engine of destruction, and will pull the small boy, who with human arrogance is holding it at the end of a long rope, headlong after it.

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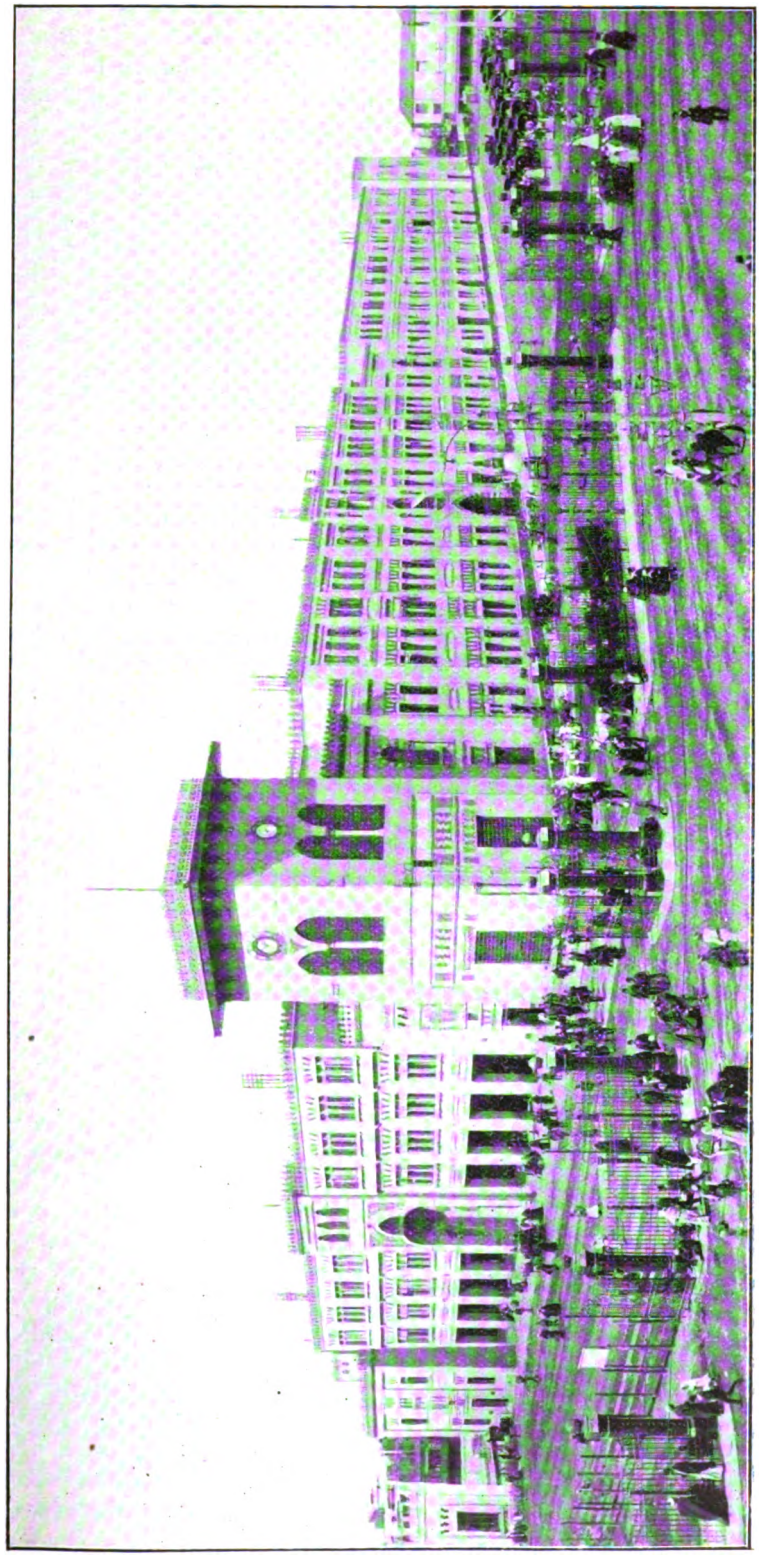

EGYPTIAN STATE RAILWAYS: THE STATION AT CAIRO.

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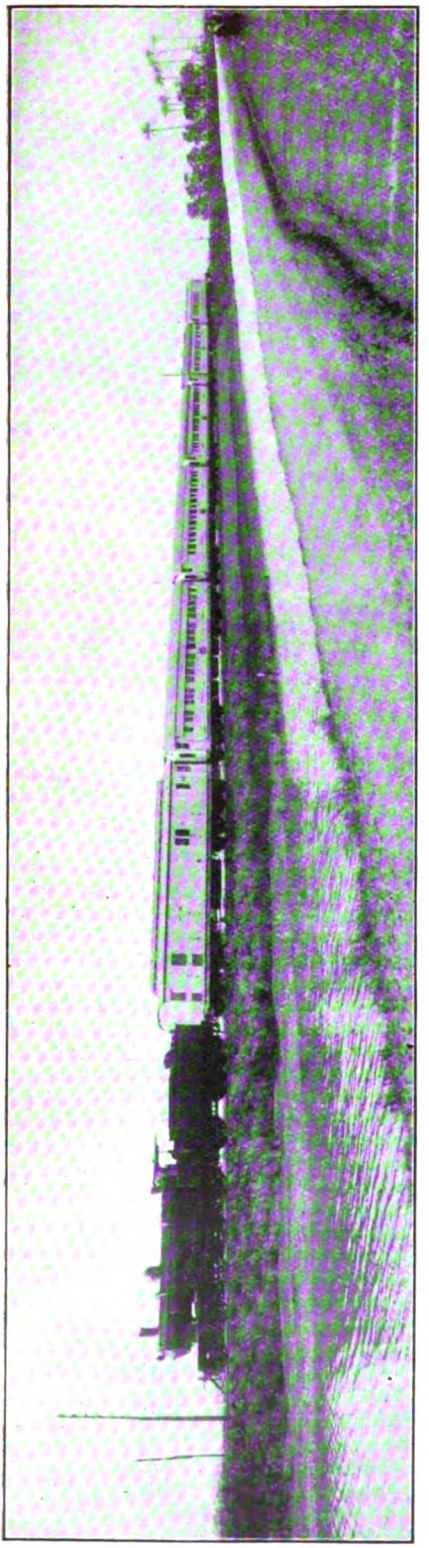

EGYPTIAN STATE RAILWAYS.
Train *de luxe* which, during the winter season, runs between Cairo and Luxor three nights a week in each direction. The locomotive is a De Glehn compound.

Thus the tourist will go on at fifty miles an hour through this hive of industry, and after lunching in the restaurant car, will see the hills of the desert narrow down, and the pyramids rising up in the far distance, until he slowly steams at Cairo into the handsome terminus, which with its five platforms and generally well-kempt air is rather reminiscent of the Great Central station at Marylebone.

The visitor will probably go on to Luxor, in which case he will travel by the *train-de-luxe* shown on this page ; but, as it will be at night, we can only wish him good repose. Anyhow, when he leaves Egypt, the State railways, with their corridor trains, Anglicised stations, polite officials and Western comfort, amid the interest of Oriental scenes, will remain in his memory as not the least of the pleasant impressions which he has gained from his visit. The tourist probably went up past Luxor to the great dam at Assouan by the special narrow-gauge line of the State Railways that continues the route to the Cape. Perhaps he proceeded to the Sudan, and crossed the desert by that wonderful line which Lord Kitchener built when he was campaigning against the Madhi ; or perhaps he returned by steamer from Luxor, after having satisfied himself in the relics of that unique country, and no doubt he left Cairo one Monday morning, and got on board a P. & O. steamer at Port Said.

But I hasten to the facts I had prepared for the reader. The Socialist will be pleased to learn that the railways give a return on their capital expenditure of between 5 and 6 per cent. per annum. The engineer will be disgusted to know that there is no tunnel and no cutting on the whole 1,454 miles of the railway, and the enthusiast, who " thinks in gradients," and respects nothing over 1 in 100, will be speechless when he hears that practically speaking the whole of our system is flat! I can imagine the look of disgust on his face as he tries to picture *one thousand five hundred miles* in this unexalted condition! But he will be mollified somewhat when told that the almost constant northerly winds make it no easy matter for the expresses running

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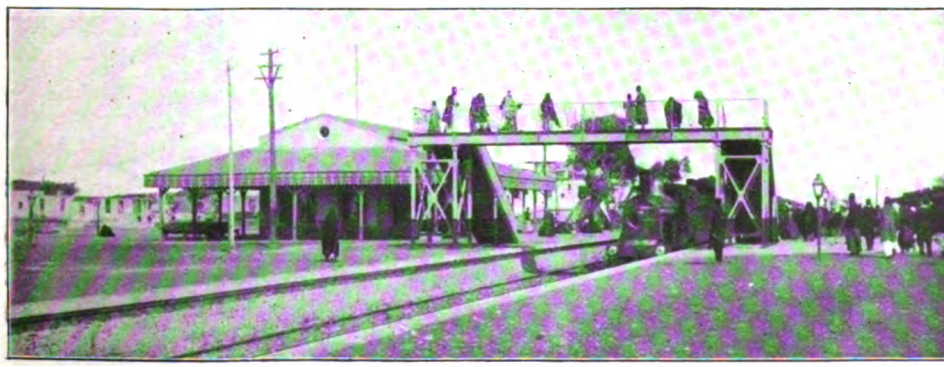
EGYPTIAN STATE RAILWAYS: PORT SAID EXPRESS LEAVING CAIRO STATION.
The white vehicle is the Restaurant Car.

north to keep time. In the summer, when these winds are at their worst, they increase the coal consumption on the Cairo-Alexandria expresses by nearly 30 per cent.

The enthusiast who does not know the country would be surprised to see the fine express engines we have. In their deep crimson, with shining brass domes, they look simply "Pharaonic." With the De Glehn compound he will already be familiar. The 4–6–0 type, built by the North British Company, resemble the standard English express locomotives. Both these classes have done and are doing well. The permanent way staff grumble at their weight, and even now many of the bridges are being strengthened. Otherwise, everyone is satisfied. The drivers like them, because they find it easier to keep time with them than with the 4–4–0 type, which still constitutes the more numerous class. The usual weight of the Cairo-Alexandria expresses is 350–400 tons, and this, with a heavy head wind, makes it no easy work to keep time. "You say it is 130 miles between these two places"—I imagine our railway enthusiast to continue—"I suppose your fast trains do it in two-and-a-half hours?" He will not conceal his disdain when I tell him that the fastest train takes three hours for the journey. That includes three stops and two bad slacks—one for the bridge over the western branch of the Nile, the other for the junction of Damanhour, which is on a nasty curve. With these allowances, the average running time works out at something less than 50 miles per hour—not much, I admit, for De Glehns or North British 4–6–0's. Nevertheless, it is the fastest train in Africa. We could go faster, but what would be the good?



EGYPTIAN STATE RAILWAYS: ALEXANDRIA–CAIRO EXPRESS PASSING CALIOUB JUNCTION.

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Who wants to save time in the East? As it is, an Egyptian, when he goes on a journey, always likes to be at the station three-quarters of an hour before the train starts!

Colonel Macauley, of the Royal Engineers, is the General Manager of the railways; the Chief of the Locomotive Department is Mr. Trevithick, a member of a well-known railway family; and nearly all the chief posts are held by Englishmen. The railways look English—the stations with their high platforms, the semaphore signals, the level-crossings, "all, all are English." In the stations notices are in Arabic and English, and all the officials speak English. Nothing has been more remarkable than the manner in which the system has of late years developed. In the last decade the number of passengers carried has doubled. It amounts to-day to over 26,000,000, and this without any great development of suburban traffic. Very little of this volume is lucrative traffic. Most of it at Alexandria and Cairo, our only two big towns, is dealt with by the electric tram. There is really only one line on which anything worthy the name of a local train service exists, and that is between Cairo and Zeitown. On this line—about a dozen miles in length—there is a half-hourly service run by powerful tanks of the 4–4–2 type, with comfortable trains made up of corridor bogie coaches.

EGYPTIAN STATE RAILWAYS: EXPRESS LOCOMOTIVE.

Many who have their work in Cairo live on this line, and its speedy and frequent service gives satisfaction. There is, at least, very little grumbling. The goods traffic consists mainly of cotton, coal and wood for building purposes. After the picking in October, cotton puts a heavy strain on the Goods Department, whose staff transport it from the Delta lands to Alexandria. But it must be remembered that in this matter the Nile waterways are serious competitors, and for that reason the goods traffic is not so large as it would be otherwise The means for dealing with it are, however, quite up-to-date. Thirty-ton bogie wagons are generally used, and the latest goods engines are fine examples of the British workmanship. So much, then, for these few jottings on the Egyptian State Railways system, which runs from the Mediterranean down to the tropic of Cancer at Assouan, without a tunnel or a gradient. It is unnecessary for me to tell you to come and see for yourselves. Nowadays everyone means to see Egypt before he dies. But when all is said and done, there is no more striking tribute to the work of the British in Egypt than the efficient and up-to-date State Railways.

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Railway Signalling in Principle and Practice [No. IV].

By W. E. EDWARDS.

THE ELECTRIC TRAIN TABLET OR ELECTRIC TRAIN STAFF BLOCK SYSTEM.

THE use of tickets in combination with the train staff, although safeguarded in the manner previously indicated, involves, as has been seen, certain drawbacks, if not, indeed, tending, in some degree, to defeat the desired purpose. This fact was recognised, as long ago as the year 1878, by Mr. Tyer, who then patented the well-known method of single-line protection termed the "Electric Train Tablet" system. By that means tickets were entirely dispensed with, while at the same time the principle of the "staff only" method was combined with that of block telegraph working. This invention was followed by Messrs. Webb & Thompson, of the London and North Western Railway, in 1889, when the popular appliance described as the "Train Staff Block" apparatus was introduced, the authors having in view the desirability of retaining the old form of train staff familiar to several generations of enginemen. The writer, therefore, selects first for consideration the later invention.

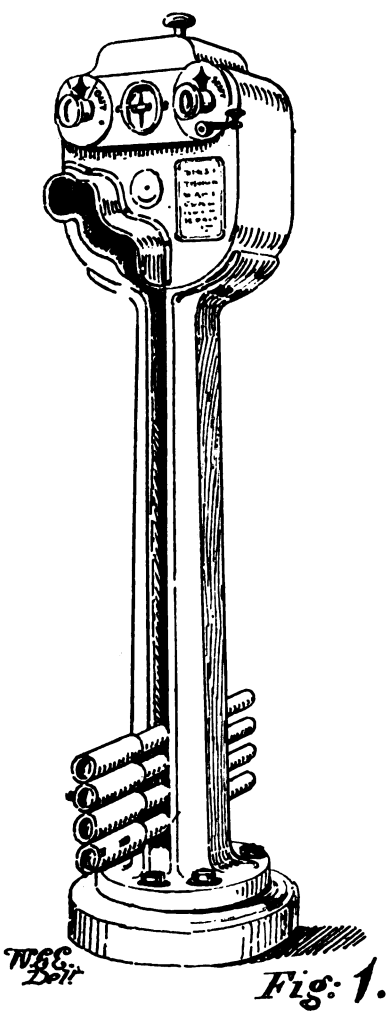
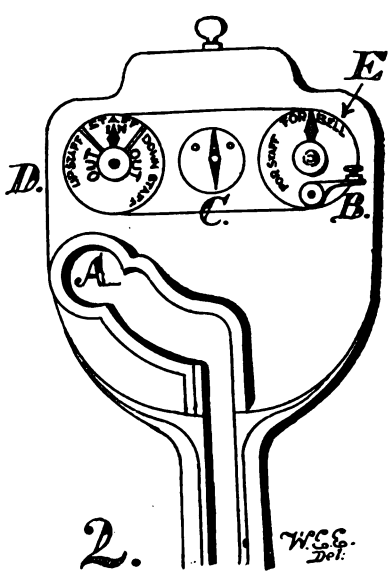


Fig: 1.



By way of explanation, the exact definition of the system, as contained in the Appendix to the Standard Railway Regulations and running thus is here reproduced :—

"The object of the system of Electric Train Tablet or Electric Train Staff Signalling is

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to prevent more than one train being between any two Tablet or Staff Sections at the same time, and, when no Train is in the Section between two Tablet or Staff Stations to admit of a Train being started

Fig. 3. W.E.E. Del.

from either end. This is accomplished by every Train carrying a Tablet or Staff, one Tablet or Staff only being obtainable from the Tablet or Staff Instruments of the same Section at the same time." Despite the fact that although a considerable number of staffs* exist, the foregoing makes clear that the "staff only" system is necessarily involved. No tickets are therefore employed, and such is the *modus operandi* that the equivalent of actual block working is therewith combined, so satisfying the requirements relating to the working of single lines of railway. In short, the security of the "staff only" method is obtained, yet the staff is available for a train in either direction.

The mechanism of the electric train-staff instrument, as manufactured by the Railway Signal Co., is of the most ingenious, and, at first sight, complicated description. Nevertheless, the actual operation is extremely simple. Within the signal cabin at either end of the single-line or "train-staff section," is placed the apparatus illustrated by Fig. 1. The instrument is about 5 ft. in height, and is usually painted scarlet, the object being a familiar one upon the Great Western Railway system in particular. The inventors describe the instruments as "magazines electrically connected and controlled as to prevent more than one staff being in use at a time." Fig. 2 is an elevational diagram of the upper part only. A is the aperture through which a staff may be withdrawn, or inserted, as the case may be, the operation being impossible at any other point. B is a tapper-key, by means of which electric-bell communication is made with the corresponding apparatus at the next staff station. C is the galvanometer, the needle of which informs the signalman as to the direction of the electrical current.

* Now the official plural, older books of Instructions say 'staves.'

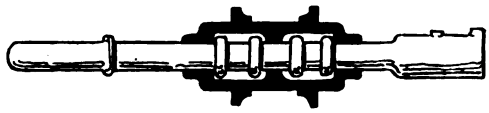

Fig. 4. W.E.E.

D is a pointer, which is operated mechanically, and serves to remind the signalman if a staff is "in," or "out," and whether for an "up" or 'down" train. This indicator also works the discs sometimes provided at intermediate level crossings, should such exist within the staff section. E is an electrical switch which determines whether the current is to be used for striking bell or for exciting the staff coils. The usual electric bell employed for train signalling purposes, is contained within the instrument. The number of staffs contained in the two instruments is usually twenty, but in some cases as many as forty are supplied.

Fig. 3 represents a common pattern of staff consisting of metal. The average weight is 1 lb. 12 oz. The length is about 24 in. Fig. 4 indicates a sectional view of the pillar of the apparatus, distinguished by dark shading. The method by which the rings, or lifting pieces, formed upon the staff, secure it within the machine will be observed. It is impossible to withdraw a staff therefrom, although at any time it may be raised

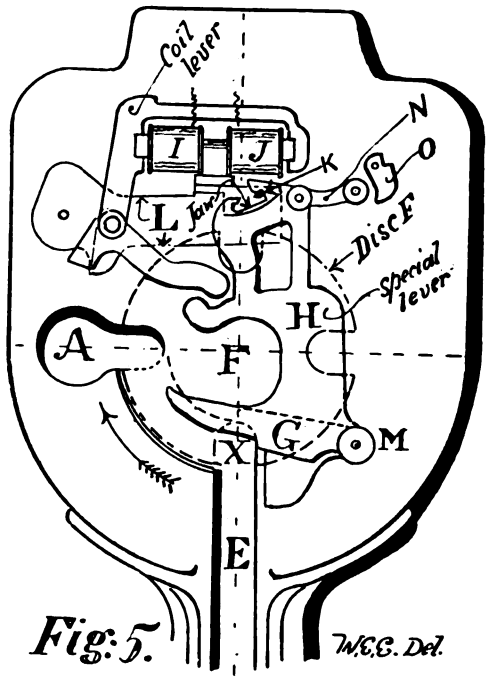

Fig. 5. W.E.E. Del.

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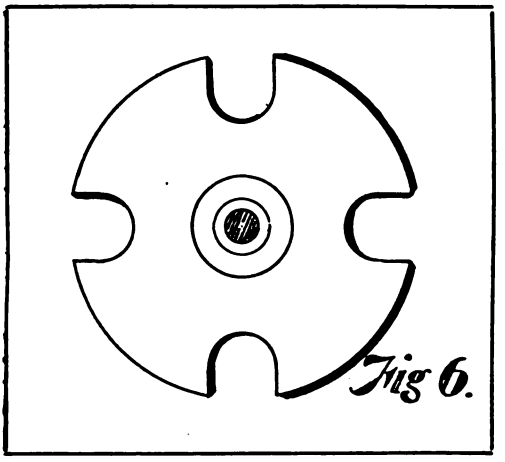
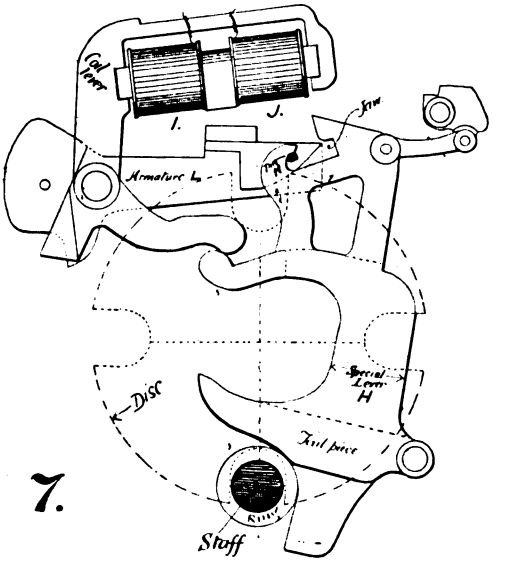


as far as the drum-head of the machine, where the mechanism hinders the operation. Upon the head of the staff, in this example, may be noticed two nibs. These form a key which is employed to lock or unlock the points, where such exist, at intermediate positions between the staff stations. Fig. 5 is a sectional view of the head of the machine, having its front removed. Topmost will be noticed two electro-magnet coils, I,J, carried by the coil lever indicated. Below is the armature lever L, upon which is a pin K. Normally the pin is engaged with the jaw at the position shown upon the "special" lever H, which is itself pivoted at M. E is the slot in the pedestal aforementioned, and which continues, in the direction of the arrow, to aperture A. F is one of a series of five metal discs varying somewhat in pattern, but most of which, with one exception, and saving certain details, are of the type represented by Fig. 6. The discs are about 8 in. in diameter, revolving upon a common axis, and set at a distance of about 1 in. apart. The four notches indicated are provided to receive the shaft of the train staff, which is about 1¼ in. in diameter.

Returning to Fig. 5, it may be noted that in extracting a staff the latter travels up the slot in the pedestal and next engages with the lower notch in disc F; and if the apparatus be free, the staff likewise carries the discs with it, in the direction of the arrow, until aperture A is reached. In so doing, a quarter revolution of the discs, therefore, takes place, while the aperture A, as explained, is the only point at which a staff may be extracted. Although mechanical, this revolution of the discs is dominated by electrical means, *i.e.*, the consent of the signalman at the other end of the staff section must first be obtained, and this consent is conveyed by the transmission of an electric current. We now assume a staff to be lifted (of course, in a horizontal position) as far as X, in Fig. 5, at which point also is the above-mentioned lower notch in Disc F. G is a tail-piece, pivoted at the same point M as lever H, and partially obstructing the slot through which the staff travels. When a staff is raised, this tail-piece is elevated in the manner shown by Fig. 7, while special lever H also moves to the right as indicated, pin K now being engaged at the left-hand extremity of the jaw. Magnetic coils I, J are likewise raised as shown. These movements, nevertheless, are insufficient for releasing the staff, because the distant signalman has not, as yet, transmitted the necessary current. Therefore the coils, although raised, are still unenergised, consequently pin K continues to lock up the apparatus.

Assuming next that the distant signalman be prepared to accept the train, and therefore wishes to release the staff. Pressing bell key B, he accordingly energises coils I, J, and the contact of the staff (or, rather, of the rings, or lifting pieces thereon) with special lever H, has disengaged pin K, as shown in Fig. 8, while the armature lever L is attracted by the coils to the position shown. The discs are now freed, and travel with the train staff for the quarter revolution alluded to. Nothing remains but to with-



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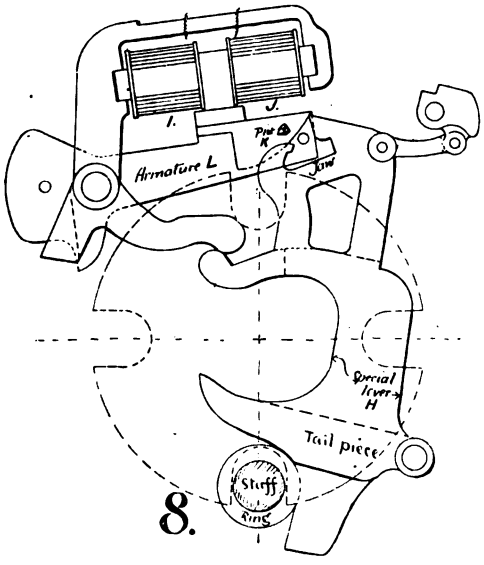

draw the staff from the aperture. The mechanism is again locked, and no other staff is obtainable until that withdrawn has been carried to the end of the staff section, and inserted in the instrument there, and then only when the operations indicated have been repeated, whereby no train in the opposite direction is to be dispatched. It may be mentioned, however, that should the staff withdrawn not be, for any reason, required, it may be replaced in the instrument, and in so doing the discs turn (for the quarter circle) in the reverse direction, that movement restoring the electrical mechanism and apparatus itself to the normal position without making any communication with the opposite end of the staff section.

The dominating feature of the apparatus, as already noticed, is that of electrical control, effected by a series of switches. Thus, when a staff is carried from station A to station B and placed in B's apparatus, the electrical switches are reversed in the process, just as signalman A reversed those of his own instrument by drawing the staff therefrom, a positive or negative current alternating with each use of the mechanism, whether coils or switches. So, for example, should signalman B transmit a second current after the withdrawal of the staff by A, the reversed polarity would prevent the induction of the magnetism, without which the locking pin cannot be released. Another special lock within the apparatus precludes the possibility of the extraction of a staff by any but the proper means. Briefly summed up, the system ensures that (a) one staff only may be out at one time; (b) when one staff is taken out at station A another cannot be taken out at station B, nor can another be taken out at A until the staff already withdrawn has been either replaced in the home instrument or in the instrument at station B. Should there exist a train staff section in both directions from a given station, the internal construction of the two instruments in the signal box is so differentiated that any one of either set of staffs cannot by mistake be placed in the wrong instrument. On Fig. 5 should also be noted a connection N, with special lever H, existing only, however, in modern type machines. Connection is so made with switch O, that the local battery is automatically switched in. This dispenses with the use of the right-hand indicator before and hereinafter alluded to.

Proceeding to the method of train signalling under the electrical train staff regula-

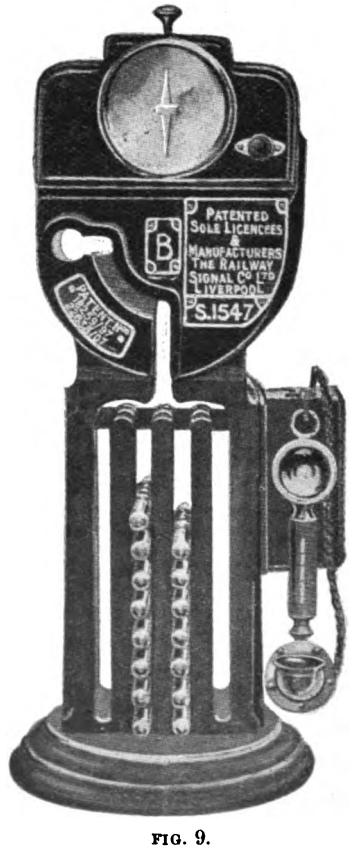

FIG. 9.
Railway Signal Company's "S" type minature apparatus.

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tions. As stated, the ordinary block telegraph instrument, as employed upon double lines of rail, is dispensed with, the staff apparatus occupying virtually the same position. With few exceptions, the bell-code itself is likewise identical with that used for double line operation. The outdoor signalling is also of a similar character, excepting that its operation is dominated by the train staff regulations instead of by those of the block-telegraph, as on double lines. For example, the signalman must not lower his starting signal unless the train staff be actually withdrawn from the apparatus. Neither must the engineman start until the staff be handed him, even though the signal be lowered, and the guard's signal also given. Assuming a train to be waiting at station A, in order to proceed over a single line or train-staff section to station B, and given also that "Train out of Section" has been received by A for the previous train and that the block indicators are in their normal position, and provided also that no permission has been given for a train to approach in the opposite direction. No staff will, therefore, be outside the apparatus either at A or B. Signalman A first sends to B the "call attention" signal, one stroke of the bell. B replies by one stroke. A next sends "Is line clear?" the number of strokes describing train.

If the line be clear, under the conditions before enumerated, B replies "Yes" by repeating the number of bell strokes sent by A; but in pressing the bell key for the last time, B keeps it down until he sees the galvanometer needle return to the upright position. By holding down the key, B has deflected the needle in his own instrument as well as in A's. A, seeing the needle in the deflected position, turns the righ-hand indicator to the "For staff" position, and immediately withdraws a staff, while, in so doing, the same indicator is mechanically re-pointed to the "For Bell" position. After obtaining the staff, A turns the left-hand indicator to "Down (or Up) staff out," pressing it hard down for a moment. This movement causes the central needle to return to the vertical position in both signal boxes, and the fact of its doing so informs signalman B that a staff is withdrawn from A's instrument, and the leftward indicator turned by him. B ceases to hold down the bell key and turns his left-hand indicator to "Up (or Down) staff out." A hands the staff to the driver, and (if the line be clear) lowers his starting signal. Upon the departure of the train, A sends the "Train entering section" signal by two beats upon B's bell, which the latter acknowledges. As soon as the train arrives, B takes the staff from the driver, and *when he is satisfied* that the last vehicle has arrived, with tail lamp in position, B places the staff in his own instrument and sends A the usual "Train out of section" signal (2, pause, 1). Both signalmen next re-point their left-hand indicators to "Staff in." The instruments are again in their normal position at each end of the section, and may again be used for an engine or train in either direction.

Although at first sight these operations appear to be somewhat protracted, such is not the case in actual practice, the process occupying little more than a few moments. Of this system generally, whether the medium be tablet or train staff, the facility is such that the duplication of many miles of single line railway under the old conditions rapidly becoming imperative, has thus been indefinitely postponed, if not entirely avoided. Fig. 9 illustrates an improved "miniature" staff instrument devised by the Railway Signal Co. The staffs weigh only 8 ozs., are but 9½ in. long, and thus suitable for exchange at high speeds by means of an automatic apparatus. The height of the instrument, which may be placed on a shelf, is 26 in. Four slots provided obviate the necessity of using the same set of staffs again and again. The telephone attachment allows the operator to speak to the sections on either side, and is always in circuit. Yet it may be readily detached, and one line wire suffices for all purposes. The service of current is a magneto generator, one only being required at each station. The system also allows of the switching out of an intermediate train staff section, should such exist, while the use of the pointer is dispensed with, together with other modifications.

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Some Branch Railways in South Devon.

[No. 1.]

By J. B. BARON COLLINS, M.A.

[Illustrated by views taken for this article by arrangement with Mr. A. J. F. Bond, of 85, Fore Street, Bodmin.]

THROUGH the kindness of Mr. Herbert Rake, who has contributed many interesting articles to the RAILWAY MAGAZINE, I have been able to attempt a description of these branches, to supplement the accounts of other lines in this part of the West of England. Mr. Rake has given me much valuable information, on condition that I wrote the account which he wished to be the work of one living in the district and in touch with it.*

The first main line to be constructed as the great modern highway through Devonshire was what later on became part of the Great Western Railway system; the last part of the Bristol and Exeter main line was the Devonshire portion, for the Whiteball tunnel, which was the final obstacle, is cut under the ridge that divides Somerset from Devon. Exeter people hoped that no lines would be constructed west of their city so that traffic should not pass through without being much handled and passengers also, as far as their money was concerned. Bed and meals for a few hours at least, and then a coach journey to the regions beyond were thought more paying for Exeter than being what it has become, an excellent railway centre. Modern Exonians are, no doubt, glad that Exeter is not a sort of Land's End. But formerly Plymouth people had to inform Exonians that everyone did not buy Exeter spectacles. These dear Exeter people were dreadfully afraid that traffic "would merely pass through." In the "forties" the route between Exeter and Plymouth was being much discussed, and how best to reach Exeter by the narrow gauge system, the Bristol broad gauge having been opened to Exeter as early as May Day, 1844. There were four routes* suggested between Exeter and Plymouth, and till something was settled, it was not easy to arrange branch lines. The Torquay and Brixham line with the Kingswear extension, according to the South Devon plan, was originated "at one go" in 1847.

The trouble in South Devon was how to reach Dartmouth, which was on the west side of the Dart, while Torquay, Paignton, Brixham, and even Kingswear were all big enough even in 1840 to attract a railway. The Dart was to have been crossed near Dittisham where there is a narrow bit. Dartmouth and Brixham would have been termini, and after Newton Abbot the line would have served Chudleigh and Moreton Hampstead and joined the proposed Cornwall and Devon Central Railway, also narrow gauge, which was proposed instead of the more costly route of the Cornwall Railway and South Devon Railway. The Cornwall and Devon Central would have been from Exeter through Okehampton and Launceston by the Camel Valley to Truro, Penryn, and Falmouth. The Cornwall and Devon Central bought the isolated Bodmin and Wadebridge system, but was never constructed, and the London and South Western solved the difficulty by taking over the line when the Cornwall and Devon Central Company was dissolved.

In the session of 1846, the South Devon extension for Torquay was sanctioned to leave the main line at Aller (about a mile south of Newton Abbot) and to terminate at Torre, three-quarters of a mile north of Torquay. This portion was opened in 1849. There is an intermediate station at Kingskerswell. The original line into Torquay had

* The editor and manager of Trewman's *Exeter Flying Post*, founded in 1763 (Mr. A. E. Richards), has kindly given much help in dates.

* 1. Chagford, Princetown, Plymouth (most direct but worst gradients), 42½ miles. 2. Crediton, Okehampton, Lydford, Tavistock, 56½ miles. 3. Teign Valley, Totnes, Plympton, 47 miles. 4. Present South Devon route, by Exminster and Dawlish, 52¾ miles.

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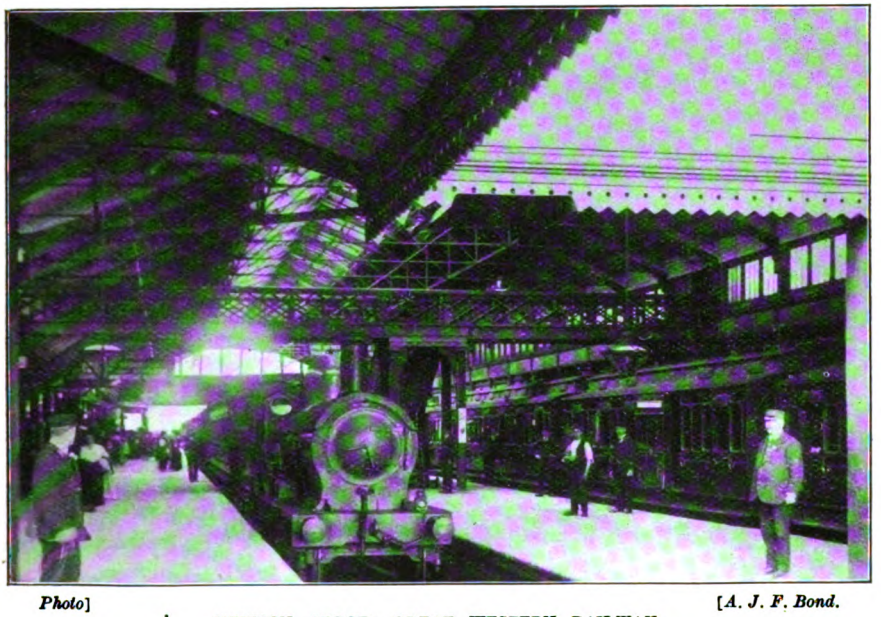
passed the House of Commons, but the Committee of the House of Lords refused to sanction the railway further than Torre, there being opposition to the line proceeding into the town itself. But as soon as trains reached Torre, it was seen that communication with Torre was wanted by all the other places at last linked on, though it was not till the summer of 1859 that the Paignton extension with a station at Torquay (though not at all central) was opened, and Brixham had to wait till December, 1860, with a reversing station, planned to be a junction, at Churston, where there is now a good golf course. There is a cutting through granite north of Churston.

on which Paignton station comes. There is a good rise to Churston of 2 miles at 71 and 60 mostly, followed by 2½ miles drop not quite so steep, with a tunnel followed by three viaducts and then a mile of level at the end of which is Kingswear station.

Dartmouth is reached by a new and commodious ferry steamer, the *Mew*, replacing the *Dolphin*, which operated this service for a long period. The two riverside stations at each end of this ferry were described and illustrated in Vol. IX. of the RAILWAY MAGAZINE. But for the absence of rails Dartmouth station is like any ordinary station. Many people think that a line ought to have been brought right into the



Photo] [*A. J. F. Bond.*

NEWTON ABBOT: GREAT WESTERN RAILWAY.

There are now double lines between Newton and Truro and Newton and Paignton, without any junction at Aller though side by side from there to Newton. The gradients between Newton Abbot and Aller are very easy, 264, 229, 276, for short bits of 3 furlongs and a few yards of level between the slopes being down, up, and down respectively, followed by easy up slopes for a branch till a mile short of Torre where there is a short bit of level and a steepish drop to Torre. The short level of that station is followed by three-quarters of a mile of 55, but nearly half a mile at Torquay is level. There is a hump with a tunnel, followed by a slighter one, and a mile of level

town. Many years ago there was a project to make an easy gradient line from near Churston serve not only Dartmouth but Modbury and Yealmpton, and to have reached Plymouth by a course ending with such a line as the Yealmpton branch, so that fast trains could avoid the two summits between Newton Abbot and Plymouth though travelling by a longer route. Others have thought that the main line between Newton and Totnes ought to have been carried round by Torquay and Paignton, so that more towns might have been on the main line. The Churston-Brixham branch is easier than most of the Newton-Kingswear portion, the two miles of line containing

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gentle slopes till the last half mile, which is a drop of only 82.5 towards Brixham station, high above the sea. The author of the hymn, "Abide with Me," was Vicar of Brixham in the early "forties." A few years ago a short portion of the line near Paignton had to be shifted further from the sea, owing to slips of the low cliff and the danger of rough seas undermining the railway. From Newton to beyond Paignton there is red sandstone, excepting Torquay, where it is limestone. Nearer Kingswear the soil is yellowish.

Paignton is celebrated for its puddings. There was one in 1809 consisting of 400 lbs. of flour, 240 eggs, 140 lbs. of raisins, and 170 lbs. of suet. It required four days' cooking, and a team of oxen to draw it. The opening of the South Devon Railway in 1859 was observed, *inter alia*, by a pudding. This time there was no boiling but baking, the pudding being divided into 8 portions and afterwards put together, the total weight being 30 cwts. There were 573 lbs. of flour used, 382 lbs. of raisins 191 lbs. of currants, 191 lbs. of bread, 382 lbs. of suet, a great number of eggs, 360 quarts of milk, 320 lemons, 95 lbs. of sugar and 144 nutmegs. The cost ran to nearly £50 and the pudding was drawn by eight horses to the green, where a public dinner took place.

The traffic on the Kingswear line is now considerable, and Newton Abbot station is far more important than anyone expected in the early days. Newton Abbot used to be considered a decayed place, made up of a village in two parishes—Newton Abbot in Wolborough and Newton Bushel in Highweek. The town became a railway centre, and had the repairing works of the South Devon Railway, now extended and the chief place of its kind west of Bristol (or west of Swindon as far as the Great Western Railway is concerned), excepting Highbridge. The Moretonhampstead line runs out northward, leaving the main line at once and not permitting a non-stop run between Teignmouth and Teigngrace. The line traverses the valley of the Teign till halfway between Teigngrace and Heathfield, then using the valley of the Bovey till just before Lustleigh, and finally a stream which rises a little beyond Moreton Hampstead. Heathfield was called Chudleigh Road till the Ashton branch gave a station a mile from Chudleigh. There is a straight stretch of line northwards for a mile. On the left as we go to Moreton the view of the moors is very fine, and there are charming spots for picnics in all this part of Devon. The line crosses the stream just after Bovey and shortly before reaching the terminus, which is one of those dignified looking

Photo] [*A. J. F. Bond.*

PAIGNTON: GREAT WESTERN RAILWAY.

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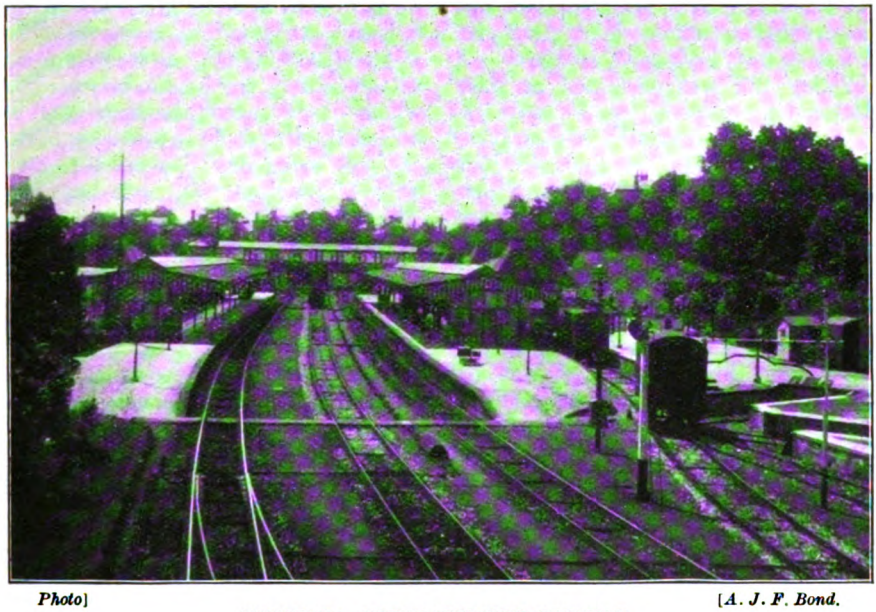
roofed in sheds coloured buff, so much the fashion where Brunel had the planning.

A glance at the gradient profile reveals a rise nearly all the way in going to Moreton Hampstead, the gradient being more severe at the Moreton end. There is a Great Western motor omnibus service in connection with the principal trains from the terminus to Chagford, as well as a road motor 'bus service by the London and South Western Railway from Exeter to Chagford, formerly from Yeoford Junction to Chagford, and a 'bus service from Okehampton to Chagford. In the summer Great Western automobile observation cars also run from Moretonhampstead across Dartmoor to Princetown.



Photo] [*A. J. F. Bond.*

TORQUAY: GREAT WESTERN RAILWAY.

The scheme to connect Chagford with Exeter by railway fell through a few years ago, and the rise in the ground between Moreton and Chagford seems too much for a direct line between these two charming moorland resorts. Both have interesting old West country type churches, and there is good accommodation for visitors. Moreton is on the great road highway from Exeter to Plymouth by Dartmoor with the Tavistock, Liskeard and southern coach route through Cornwall of earlier days. Bovey is a moorland resort. The Teign Valley line was intended to be completed between Heathfield and Exeter years sooner than was the case north of Ashton. The easy portion was soon opened, and Newton Abbot got much of the trade of the district, which in non-railway days would have gone to Exeter. Between Heathfield and Chudleigh stations the line falls and rises twice, crossing a moor, passing through a cutting near Chudleigh Knighton, a village with a small church, and then begins its course in company with the Teign, crossing it five times before reaching Christow, now the most important station between Heathfield and Exeter where trains can pass, the other stations being very small—one platform affairs, with no signals.

Chudleigh station, having only one platform on the east of the line, is like many of the smaller ones in South Devon or Cornwall, with wooden sides on which sand has been splashed and buff paint laid on top giving a pleasing effect. Trusham and Ashton are the only other stations, and for a long time there was no passenger traffic beyond Ashton though the line was completed as far as Teign House, very near Christow station. The gradient profile shows that nearly two miles of line were constructed beyond Ashton with easier gradients than those near Moreton. The Teign Valley trains are, as a rule, drawn by small side tank engines, running backwards towards Heathfield, and the Moreton by the larger saddle tank engines, turn-tables being used on this

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more busy line. The Ashton-Exeter portion of the route was described and illustrated in the August number of the RAILWAY MAGAZINE for 1903, Vol. XIII. Between Heathfield and Ashton the line was opened in 1882, and the Act for the Exeter line and Chagford extension obtained in the following year was renewed by numerous extensions of time Acts, and by the abandonment of the valley route between Christow and Chagford in 1898, the Exeter line not being begun till November, 1894. Lady Northcote then cut the first sod; but the line was not opened for traffic until July 1st, 1903! Worked by agreement at 50 per cent. allowing 25 per cent. rebate, the Moreton branch had been projected in August, 1861. The Act was obtained in 1862, and the line was constructed as a branch of the South Devon and not as a separate company. A Teign Valley Bill was deposited in 1863, an independent scheme, with route as finally constructed, but the undertaking was rejected in 1864, the South Devon declining to work it. The Moreton, Kingswear, Brixham, Ashburton and Launceston (Great Western) branches were converted from broad to narrow gauge in May, 1892. Other branches in South Devon were never broad.

It is now necessary to direct attention to the Ashburton, Buckfastleigh and South Devon Junction Railway. Ashburton people first thought that their town—prettily situated with magnificent scenery of wood and tor close on the west side of it, and possessing a fine old church and grammar school (once a small church)—might be linked to the railway system by a line through a low ridge dividing the Ashburton and Newton Abbot valleys, so that Newton Abbot would have been a junction for Ashburton as well as for the other branches already described. A Bill was projected in 1845, the year of the railway mania, but a little earlier the larger scheme had been suggested of connecting Exeter and Bodmin, "throwing out a branch" southward to Ashburton. This line would have had too many of Dartmoor heights to be easy to construct, and the Tang and Tamar would have been awkward depressions.

Tavistock was to have an east to west line instead of the two present day north to south routes. Ashburton and Buckfastleigh had serge and blanket factories, and the former was very ancient and important politically, having two Members of Parliament from early times till 1832, and so it was thought that this part of Devon would be of sufficient importance for a railway as early as 1845. The capital named in the Bill for an Ashburton-Newton line, which came before Parliament in 1846 was, £130,000; but Brunel, who was engaged as the engineer, had estimated that the whole work could be completed as a single broad gauge line for £103,500, including an ample margin for contingencies. The Bill for the formation of the company passed the preliminary stages in the House of Commons, and was heard in Committee with practically no opposition, the landowners being almost wholly in favour of the line. The Act received the Royal Assent on July 27th, 1846, the line being described as 10¾ miles long with "junction at or near Newton Abbot."

On December 28th, 1846, the first general meeting of shareholders was held in the Assembly Room of the Golden Lion at Ashburton, three of the South Devon directors being present. The line was represented as easy to construct, the embankments and cuttings, though numerous, not being heavy. Negotiations with the South Devon led to the agreement that for the seven years after completion there should be a rental of 4 per cent. on the outlay not exceeding £130,000 with half the surplus profits. The chairman announced that the cutting of the line would be commenced immediately. At the next meeting, on June 20th, 1847, the directors referred to the monetary crisis in England, and said that it had been deemed prudent not to begin the railway for a time. In 1848 the same postponing policy was declared, owing to the continued monetary crisis. In 1849 it was said that the line must be abandoned unless railway affairs brightened up considerably. In 1851 the chairman advised the dissolving of the Company, the original time limit having run out in July, 1849.

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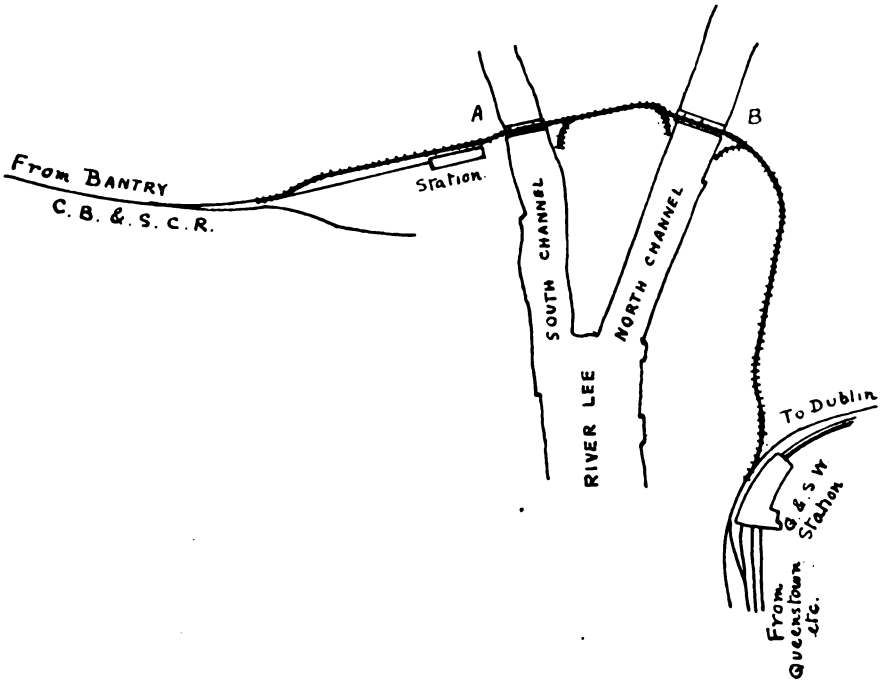
The Cork City Railways.

By CAPTAIN FITZGERALD-LOMBARD, M.A., F.S.G.

UNTIL recently the City of Cork possessed the somewhat unique phenomenon of having on its south side four separate railways, controlling respectively 93¾, 24½, 16, and 18 miles, which were not only without union with the Great Southern and Western Railway—the premier Irish system in size, and whereby Cork is connected with Dublin and virtually with the entire Irish railway system—but which had no physical connection with each other! This extraordinary condition of affairs meant, of course, that all through goods had to be transferred across and reloaded again, causing much unnecessary delay, trouble, expense and damage. In the case of perishable traffic such as fish, butter, and eggs, of which large quantities pass across Cork *en route* to London and the other English markets, inevitable delay must have been very serious.

Terminating on the south side of Cork, the detached systems referred to were the Cork, Bandon and South Coast, the Cork and Macroom Direct, the Cork, Blackrock and Passage, and the Cork and Muskerry. The last mentioned is narrow-gauge, and the Cork, Blackrock and Passage was converted from a standard Irish gauge to narrow gauge in recent years at the time extensions to the system were made. The "Passage" Company, as it is called, are now doubtless rather sorry they did so, as their Cork end is quite close to the "Bandon" system, which is being joined up by the new line with all the other Irish railways and all the ports of importance. In this case, and possibly also in the case of Muskerry line, the new junction line may lead to them having a "siding-on-to" the wide



THE CORK CITY RAILWAYS.
ROLLING LIFT BRIDGES ARE LOCATED AT A AND B.

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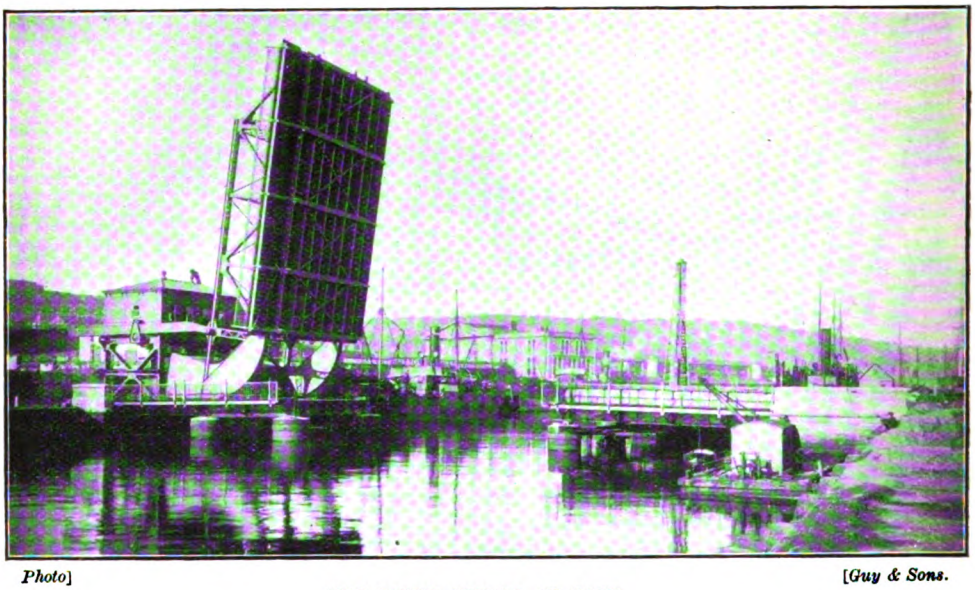
gauge system, where goods can be transferred across the platform, so that cartage and porterage may be saved; or, possibly, facilities may be arranged for working through traffic in movable wagon bodies, which can be transferred from wide to narrow gauge trucks, as is done in the case of the Donegal Railways Joint Committee's traffic to their wide-gauge neighbours.

At one time the Cork and Macroom Direct Railway used the Cork terminus of the "Bandon" system, over whose lines it ran for about a mile from a junction formed outside the city. The directors of the "Macroom," however, came to the conclusion that it would pay better to build a line into Cork city to their present excellent station at Capwell, than to continue the rent which they were paying the "Bandon" people for the use of their line and station. Hence the junction was removed. Readers will naturally be surprised that no connection across Cork has existed when there is so much perishable and other through traffic. The explanation is that, although the distance between the "Bandon" station and the Great Southern is only about a quarter of a mile, the cost and difficulties of such a scheme would, owing to the natural features of Cork, have been prohibitive. On the north side the city stands on a steep hill, through which the Great Southern comes by a tunnel, running more or less due north and south. There is towards Cork a falling gradient about 1 in 60, which begins several miles outside the north mouth of the tunnel. At the Cork end of the tunnel the line turns to the east on a sharp curve towards Queenstown. The Great Southern station, probably the finest in Ireland, is partially on this curve, and an "avoiding line" for goods and through traffic runs from the tunnel mouth south of it, rejoining the main line beyond. The connection to the goods station and locomotive shed sidings are from this avoiding line, as also is the connection with the new Cork City Junction Railway. This latter line approaches the Great Southern from the west, so that a train running to the Great Southern line would face Queenstown, and its direction would have to be reversed to go to Dublin or Fishguard. Approaching Cork from the south, the Bandon line also comes in on a falling gradient, and through a rock cutting in a rather high hill.



Photo] [*Guy & Sons.*

THE SOUTH BRIDGE AT CORK.

The River Lee runs through Cork in two channels (a large and important part of the city being on an island), so two bridges would have been necessary, and it was essential that the waterway for ships should not be interrupted.

The Great Southern and Bandon stations are both on the Cork lowest street level, so it will be seen there were enormous

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difficulties in the way of a high level line. The only other alternative, going across Cork on the street level would have entailed the purchase of so much city house property that the cost would have been prohibitive. There were other difficulties—level crossings, etc. Therefore it is not to be wondered at that for years these lines have been unconnected. The present junction line has been brought chiefly by the coming to Ireland in 1908 of an additional cross-channel route, that *via* the port of Rosslare, in which the Great Western Railway of England is largely interested, and also by permission being obtained to run the line with steam locomotives for both passenger and goods traffic along the public street.

The new line starts from the yard of the "Bandon" terminus outside the city, runs along its arrival side, then crosses the quay and the south channel of the river on a bridge of the "rolling lift" pattern, which lifts up in its own space to allow shipping to pass. As seen from an accompanying illustration, the bridge is of the cantilever type, with a large balance weight. It is operated by electrical machinery, controlled from the small house on the high level. The bridge has a roadway for ordinary street traffic and a footpath at each side, the railway being continued on the side of the roadway in "train" fashion. It is laid in this way all along to the Great Southern yard, except in a small portion where it curves from almost due north to due east, and had to be taken on a route of its own in order to secure a workable curve. The line proceeds from the first bridge along the street, curving to almost due north, crossing the north channel of the river on a bridge similar to the first, and later running for a very short way off the street as mentioned above, and finally in an easterly direction, through King Street and Alfred Street, to the Great Southern yard. Spur lines are provided to both quays on the north channel of the river and to the north quays of the south channel, so that wagons can be brought alongside ships and goods loaded and unloaded direct. The line to the south quay of the south channel runs out of the "Bandon" yard across Albert Street, then, not on the road, but as a railway proper, on a curve, and then out to the quay. All these railways are. of course, single lines, as are the whole of the "Bandon" and "Macroom" systems. As they are on the streets, the trains run at a very slow speed. The interlocking is of the standard Great Southern pattern, distant signals being dispensed with altogether. At each of the three junctions with spur lines a semaphore with two arms on the same post, one for each direction, is provided, and worked with the points from a ground frame of three or four levers. These frames are usually at other side of footpath in a recess in the street wall or at the back of the street railings, access being obtained to them through a gate. The original Cork terminus of the Great Southern Railway in Cork was on the Dublin side of the present tunnel. Then the tunnel was made, and the passenger station (now the engineer's office) was constructed near the river, together with the present goods store and locomotive shed. Meantime the Cork and Youghal Railway had arrived in a direction due east in Cork, along the side of the hill, ending in a station called Summerhill, more or less over the tunnel mouth, but much higher up the hill. A connecting line was next made along the route of the present main line, curving to the left at the tunnel mouth, and rising to join the Queenstown line. Finally the present very excellent station was constructed along the through route between Dublin and Queenstown, obviating the necessity of two stations, with four bays for local trains on the Queenstown side and the avoiding line mentioned, so that trains could run through Cork in either direction without passing the passenger platform.

It is almost unnecessary to add that, as the new line is strongly identified with two such powerful companies as the Great Western and Great Southern and Western, and also with the Cork, Bandon and South Coast companies, all the engineering work is done in very first-class style. In this instance Sir Willaim Arrol & Company, Ltd., of Glasgow, Messrs. Muirhead & Company, of London, the Cleveland Bridge Company, Darlington (who constructed the road bridge of the Bandon Railway), and Messrs. Crompton & Company, Ltd. (who supplied electrical machinery for the bridges), have quite come up to what might be expected of them. In conclusion I desire to thank, among others, Messrs. Gordon and Roberts, Permanent Way Engineers of the Great Southern and Western Railway; Mr. Kerr, General Manager of the Cork, Bandon and South Coast Railway; Mr. T. S. Brown, Engineer, Cork City Railway; Mr. Burnside, representative of Messrs. Arrol; and Mr. Christie, Director of Muirhead & Company, for all the assistance they have given me.

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Accidents on Railways.

ANALYSIS OF OFFICIAL RECORDS.

By A. ERIC FORREST, M.Soc. F.Ph.

THE recent catastrophe on the London and North Western Railway near Liverpool has served only too well to remind the public that, even in these days of luxurious travelling and intricate signalling arrangements, they are not quite immune from danger when aboard a train. In this case the accident was due to the derailment of the engine—the mishap which has accounted for the majority of serious accidents of late years. A brief review of the more notable accidents which have taken place in the history of our iron roads shows that of all the disasters, those due to collisions easily head the classified list. The appended Table I. indicates roughly the causes of 107 accidents which have taken place between the years 1830 and 1912. It will be seen that 45·8 per cent. are due to collisions between two trains in motion, 8·4 per cent. to collisions between a fast train and a stationary one, and 3·7 per cent. to collisions in tunnels—a total percentage of 57·9.

TABLE I.

Cause.	No.	Per cent.
Collisions	49	45·8
Derailment	21	19·6
Train ran into stationary train or vehicles	9	8·4
Defect in locomotive	8	7·5
Collapse of bridge	4	3·7
Accident in tunnel	4	3·7
Train divided	3	2·9
Other causes	9	8·4

A further glance at the list of mishaps shows that, although collisions figure so largely in the total, they do not occur so frequently during the early and late periods of our railway history as in the middle period. Between 1830 and 1850 we have seven accidents chronicled, every one of which was due either to a defect in the engine or track, or to improper control of the permanent way. From 1860 to 1870 there was an alarming increase in the number of "big" accidents, the period between the winter of 1860 and the autumn of 1862 embracing five collisions, which altogether accounted for 75 lives. The worst of these disasters was the Clayton Tunnel accident, in which 23 persons were killed. On September 2, 1861, a Midland Railway excursion train fouled a ballast train at Kentish Town, and 16 people were killed. A year later a nasty collision occurred on the North British Railway at Winchburg, a small place in Linlithgowshire, Scotland, and 15 people died from their injuries; while in November, 1860, a London and North Western Mail train ran into a cattle-truck at Atherstone, and 10 of its passengers were killed.

The worst disaster of all in this period took place at Abergele, Denbighshire, where the London and North Western Railway Irish Mail ran into some petroleum trucks, and 33 persons were killed. This period seems to mark an improvement in locomotives and permanent way, but many of the collisions appear to have resulted from defective control, such as the straying of trucks or wagons on to the main track in the path of express trains. Tunnels also seem to have been more troublesome at that time than at any other. The Blackheath Tunnel accident took place in 1864; two years later there was a collision in Welwyn Tunnel, on the Great Northern Railway; and as far back as 1851 the London and North Western Railway had a mishap in Frodsham Tunnel, Cheshire.

During the period from 1870 to 1890 collisions seemed to predominate as much as before, and on the whole the accidents were more serious as regards actual loss of life. This was due in a measure to the acceleration in the schedules of the big expresses which took place within this period. The collisions, although they again predominated, more often consisted of the actual impact of two trains, and less frequently the fouling of stray vehicles by expresses. Two terrible disasters occurred—the Tay Bridge accident, when 73 travellers on the North

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British Railway were drowned in the Firth of Tay, and the Armagh catastrophe, when a train full of school-children on the Great Northern Railway (Ireland) divided, ran back, and killed no fewer than 80 of its human freight. The breaking of a crank axle was responsible in 1884 for an accident at Penistone, on the Manchester, Sheffield and Lincolnshire (now the Great Central Railway), wherein 24 persons lost their lives.

From 1870 (during which year 7 accidents occurred) to 1876, there was quite an "epidemic" of accidents. In the winter of 1870 a train divided at Stairfoot, in Yorkshire, and 14 persons were killed; two years later the Kirtlebridge accident occurred on the Caledonian Railway; in 1873 a London and North Western Railway train fouled the facing points at Wigan, and the killed numbered 10. Six months later, at Manuel, in Stirlingshire, a collision took place on the North British Railway, between an express and a mineral train, the death-roll being 14. The same year witnessed the memorable Thorpe disaster, where two Great Eastern Railway trains met head on, and 25 lives were lost; and the year 1876 saw the Abbott's Ripton and the Radstock accidents, which accounted respectively for 14 and 15 lives.

From 1890 down to the present time the causes of railway accidents have been less frequently collisions and more frequently derailments. Eleven passengers were killed in the Welshampton accident, in 1897, when a Cambrian Railway train was derailed. In 1903 a Glasgow and South Western Railway train ran into the buffer stops at Glasgow station, the result being 15 deaths. The derailments at Witham (11 killed), Salisbury (28 killed), Grantham (14 killed), Shrewsbury (18 killed), and Stoat's Nest (8 killed) are recent history. Nor must I omit to mention the collisions at Elliott Junction (22 killed) and Pontypridd (11 killed), both of which accidents took place during the last few years.

Table II. is interesting in that it goes some way towards answering an oft-repeated question—"Which railway is the safest to travel on?" But in studying this table we must not recklessly judge those railways that appear at the top of the list. The London and North Western Railway, for instance, with its enormous number of long-distance and short-distance express trains, and of fast trains in the districts of London, Birmingham, and the North of England, and the Great Western Railway, also with its long-distance "non-stops," and a still greater total length of track, cannot reasonably be expected to have as few accidents as railways like the Rhymney, the North London, or the Taff Vale. Many people will, no doubt, be surprised to find the North British Railway so high up in the record. But look at the second column—only 5 accidents, sandwiched between 16 and 13! Prior to the Elliott Junction mishap in 1906, this railway had had no serious accident since the Tay Bridge disaster of 1879. The Great Northern Railway (Ireland) stands fourth with but *one* bad accident, while the Midland, with 10 accidents, is fifth. The London and South Western and North Eastern Railways seem to have been lucky, inasmuch as, in spite of their mileage and the number of their fast schedules, they appear below the London, Brighton and South Coast and Taff Vale Railways.

TABLE II.

Railways.	Total accidents.	Total k lled.
L. & N.W.R.	16	134
N.B.R.	5	100
G.W.R.	13	82
G.N.R. (I.)	1	80
M.R.	10	70
M.S.L.R. (now G.C.R.)	5	67
G.N.R.	8	65
L. & Y.R.	9	58
G.E.R.	5	43
G. & S.W.R.	3	38
L.B. & S.C.R.	5	38
T.V.R.	3	37
C.R.	4	35
L. & S.W.R.	1	28
N.E.R.	5	27
S.E. & C.R.	5	24
S. & D.R.	1	15
Cm. R.	1	11
N.L.R.	2	10
G.N.S.R.	1	5
G.C.R.	1	4
R.R.	1	3

TABLE IIA.

Railways.	Passengers. Killed.	Passengers. Carried. Millions.	Ratio. 1 in
S.E. & C.	5	59·3	11,860,000
G.E.	18	98·3	5,462,000
N.E.	12	61·0	5,083,000
L. & Y.	14*	66·4	4,743,000
L.B. & S.C.	15	57·0	3,800,000
N.B.	11	37·4	3,400,000
N.L.	10	34·0	3,400,000
G.W.	31	102·5	3,30[illegible],000
L. & S.W.	28	68·2	2,435,000
Cal.	18	40·8	2,267,000
G.N.	18	38·0	2,111,000
L. & N.W.	52	83·1	1,598,000
Midland	38	46·2	1,215,000
G. & S.W.	22	16·6	736,000

* The collision between two *electric* trains at Hall's Road, Lancashire, in 1905, when 20 persons were killed, was not included in obtaining this figure.

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Let us try a somewhat fairer test—the number of people killed in serious accidents on a few railways during the last 32 years—from 1880 to 1912—and divide in each case the number of passengers carried in 1911 on these railways by this figure (*see* Table IIA). The railways which have the highest figures may, perhaps, be considered to be the luckiest. The South Eastern Railway is very high up, having regard to its comparatively small number of very fast trains. But surely it is great credit to railways like the Great Eastern, North Eastern, and Lancashire and Yorkshire, with their large systems and many tight schedules to appear right at the head of the list. It is curious to see the North British and the North London—two such very different railways—on the same level. The Great Western, despite its huge system, is a very little way behind these two, and the London and South Western, Caledonian, and Great Northern are not separated very widely from each other a little lower down. At first sight the last three railways seem to have been rather unlucky—though the North Western, with its enormous express service (Irish Mails, Scotch expresses, Liverpool boat trains, Manchester and Birmingham non-stops, etc.), must not be carelessly judged. During 1911 the mileage of this railway was 48,000,000 miles. With its larger system, the Great Western only topped this figure by 5,000,000 miles, and the Midland just beats it by 500,000 miles.

These three railways stand easily head and shoulders above all the rest in train mileage, and if mileage instead of passengers were taken in Table IIA, the London and North Western and the Midland would have been a long way up. The ratio of the Glasgow and South Western Railway was lowered by the accident of July 27, 1903, when a train ran into the buffer stops at Glasgow station; but prior to the Barassie collision in 1898, a serious accident on that railway had not been recorded for 45 years.

People often ask, "Are railway accidents increasing or decreasing as the result of the acceleration of schedules and the multiplication of the number of express and excursion trains?" Table III. supplies an answer which cannot be misunderstood :—

TABLE III.

Years.	No. of serious accidents.	No. killed in serious accidents.
1852–1856	6	39
1857–1861	6	78
1862–1866	5	35
1867–1871	10	106
1872–1876	9	111
1877–1881	6	92
1882–1886	6	45
1887–1891	5	119
1892–1896	10	70
1897–1901	12*	51*
1902–1906	11*	118*
1907–1911	14*	64*

* Not including accidents to electric trains.

ASPATRIA STATION. MARYPORT AND CARLISLE RAILWAY.

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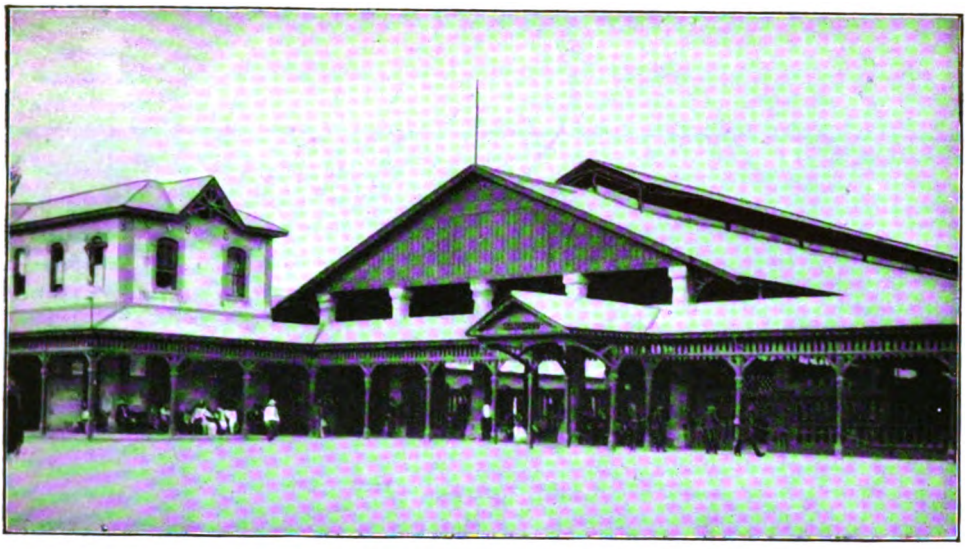

NATIONAL RAILWAYS OF MEXICO: BUENAVISTA STATION, MEXICO CITY.

The National Railways of Mexico.

MEXICO during the last two years has enjoyed a somewhat unenviable reputation owing to internal troubles. In cases these have been due to organised revolutionary outbreaks, but more often to mere acts of brigandage, which, although putting the Government to considerable expense and trouble, and the general public to a great deal of inconvenience, have in themselves had absolutely no political significance. In view of these facts, one is apt to lose sight of the great progress this wonderful country is making—progress which no amount of internal strife seems able to retard.

The development of any country goes hand in hand with the growth of its transportation facilities, and this truism is especially *a propos* in the case of Mexico. The system of the National Railways is by far the largest in the republic, comprising as it does one-half of the existing mileage. It has therefore played, and is destined to play, an important part in this development. The mistake is often made that the National Railways of Mexico are State-owned lines in the same sense in which the Belgian Railways are national property. But the Mexican Government simply owns by stock purchase an effective controlling interest in the Company, and except perhaps where important questions of principle are concerned, it does not interfere in the working or management of the lines.

Up to the year 1903 practically all the railways in Mexico were owned by private interests, chiefly British or American, but in that year the Mexican Government bought up £1,000,000 of 4½ per cent. debenture stock in the Interoceanic Railway, running from Vera Cruz to Mexico City. In the same year also the Government purchased 47 per cent. of the outstanding stock of the National Railroad Company of Mexico. By this means control in two important railways was obtained. Later it was ascertained that an influential American group was at work endeavouring to obtain control of the Mexican Central Railway, and it was decided to bring that line also into the merger. This being done, the National Railways of Mexico was finally organised in 1908.

Since then other lines have been acquired, until at the present time the National Railways Company either owns or controls the following :—

Ex-Mexican Central Railway,
Ex-National Railroad,
Ex-International Railroad,
Interoceanic Railway of Mexico,
Mexican Southern Railway,

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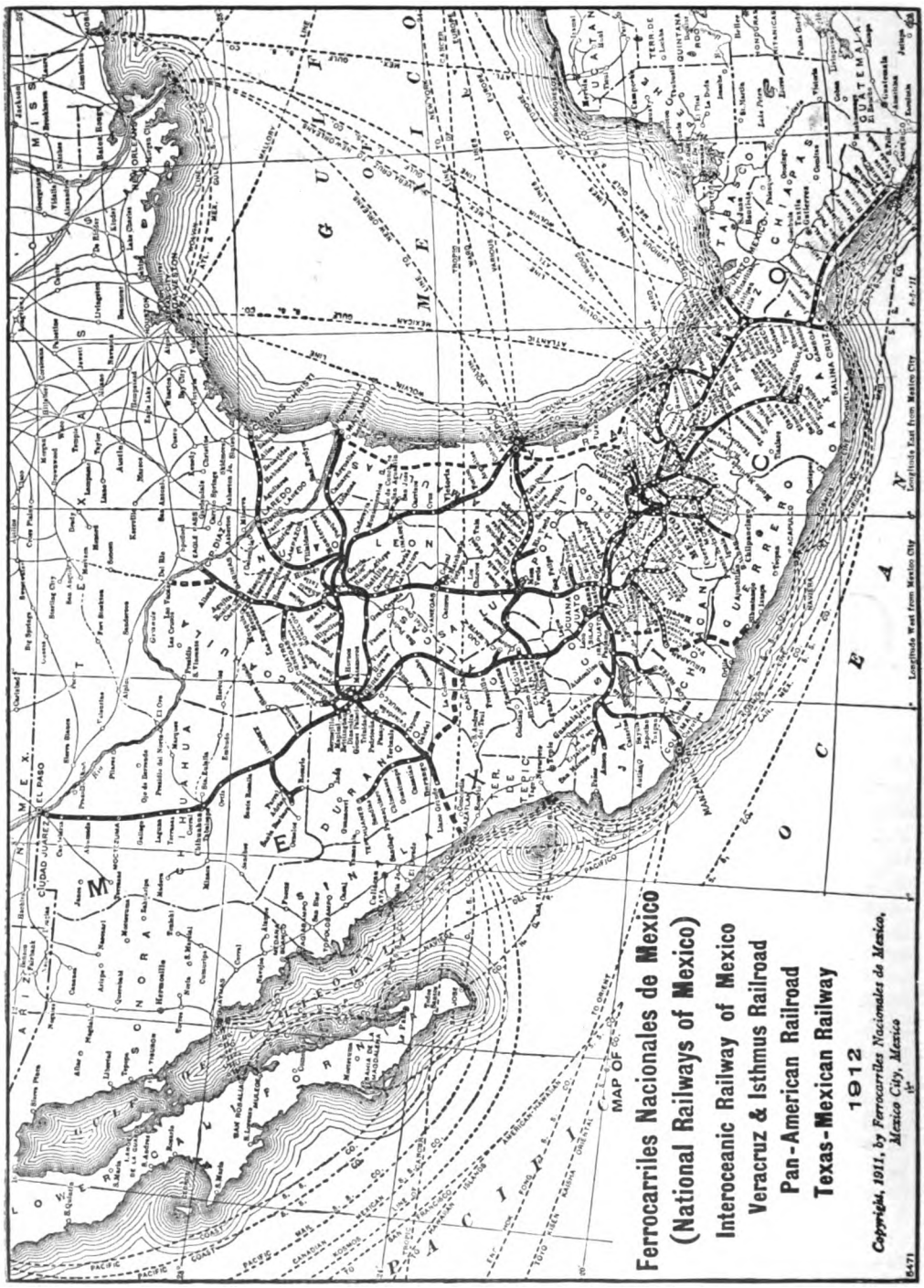

Ferrocarriles Nacionales de Mexico
(National Railways of Mexico)
Interoceanic Railway of Mexico
Veracruz & Isthmus Railroad
Pan-American Railroad
Texas-Mexican Railway
1912
Copyright, 1911, by Ferrocarriles Nacionales de Mexico, Mexico City, Mexico
MAP OF MEXICO
Longitude West from Mexico City
Longitude East from Mexico City
GULF OF MEXICO
PACIFIC OCEAN
CITY OF MEXICO
EL PASO
CIUDAD JUAREZ
LAREDO
MONTERREY
SAN LUIS POTOSI
GUADALAJARA
MANZANILLO
ACAPULCO
VERACRUZ
TAMPICO
MERIDA
SALINA CRUZ
TEHUANTEPEC
GUATEMALA
BELIZE
HAVANA
NEW ORLEANS
GALVESTON
SAN ANTONIO
CHIHUAHUA
MAZATLAN
GUAYMAS
NOGALES
TUCSON
PHOENIX
SAN DIEGO
LOS ANGELES
SAN FRANCISCO
SEATTLE
VANCOUVER
PORTLAND
SAN JOSE
SAN JOSE
PANAMA
CARTAGENA
KINGSTON
PORT AU PRINCE
SAN JUAN
CAPE HATTERAS
CAPE FLORIDA
CAPE MAY
CAPE COD
CAPE ANN
CAPE SABLE
CAPE HENRY
CAPE FEAR
CAPE LOOKOUT
CAPE MALABAR
CAPE ANTONIO
CAPE CORRIENTES
CAPE SAN LUCAS
CAPE MENDOCINO
CAPE FLATTERY
CAPE ORFORD
CAPE ELIZABETH
CAPE ANN
CAPE COD
CAPE MAY
CAPE HENRY
CAPE FEAR
CAPE LOOKOUT
CAPE MALABAR
CAPE ANTONIO
CAPE CORRIENTES
CAPE SAN LUCAS
CAPE MENDOCINO
CAPE FLATTERY
CAPE ORFORD
CAPE ELIZABETH
CAPE SABLE

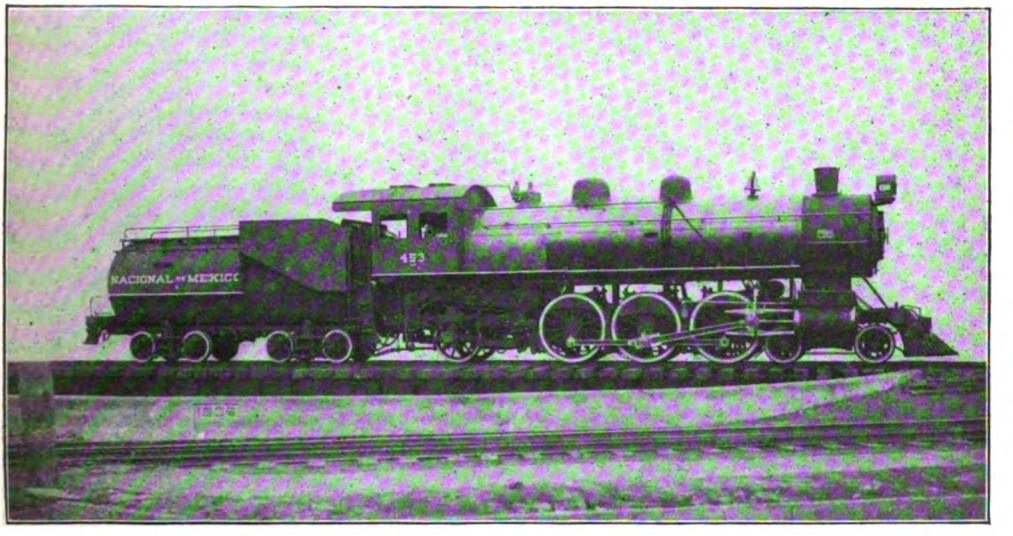
Vera Cruz and Isthmus Railroad,
Pan-American Railroad,
Texas-Mexican Railroad,
and several smaller lines.

The total length of track operated is over 8,000 miles, all of standard gauge (4 ft. 8½ in.), with the exception of the Interoceanic, the Mexican Southern and a small stretch of the *ex*-National Railroad — in all about 1,500 miles. The great tentacles of this system stretch out over the whole of Mexico. On the Texas borders there are four gateways into the United States, at Ciudad, Juarez, Piedras Negras (better known under its old name of Ciudad Porfirio Diaz), Nuevo Laredo, and Matamoros. From the first-named the line runs southward direct to Mexico City, as does also that from Nuevo Laredo. From Piedras Negras it goes due south to Reata, and thence in a westerly direction through Torreon to Durango, the capital of the important mining state of that name.

On the Atlantic seaboard the National Railways of Mexico are interested in two ports, Vera Cruz and Tampico. The former is connected with the capital, Mexico City, by the Interoceanic Railway and is the port of entry for traffic destined for the Southern States. Tampico is the port proper of the National Railways, and in addition to having a direct line to Mexico City, is the main gateway for European traffic to virtually all the most important centres of industry in the Republic.

On the west coast the port of greatest importance to the system is Manzanillo, which has direct rail communication with Mexico City *via* the rising and important town of Guadalajara. Access to Guatemala from Mexico is obtained by the Pan-American branch of the National Railways through Mariscal, connection being made with Vera Cruz and Mexico City over the Vera Cruz and Isthmus Railroad.

Already the National Railways serve all the principal cities and chief manufacturing mining and agricultural districts, but the management has under construction numerous branches, and many others are contemplated. These will open out further large areas of the Republic. By far the most important of these new lines is that linking up the two seaports of Tampico and Vera Cruz with a branch to Tuxpan, a port at present without rail communication. The total length of this construction will be about 290 miles. It will run through the oilfields districts, which have been proved to be the most extensive in Mexico. In addition, an extremely rich and fertile agricultural



NATIONAL RAILWAYS OF MEXICO: 4-6-2 ENGINE NO. 453.

Cylinders	21 in. by 26 in.	Heating Surface—Tubes ..	2153 sq. ft.
Coupled Wheels	55 in.	,, ,, Firebox ..	224 ,,
Leading Truck Wheels ..	28½ ,,	,, ,, Total ..	2377 ,,
Steam Pressure	180 lbs.	Grate area	314 ,,

Weight of Engine and Tender in working order .. 122 tons.

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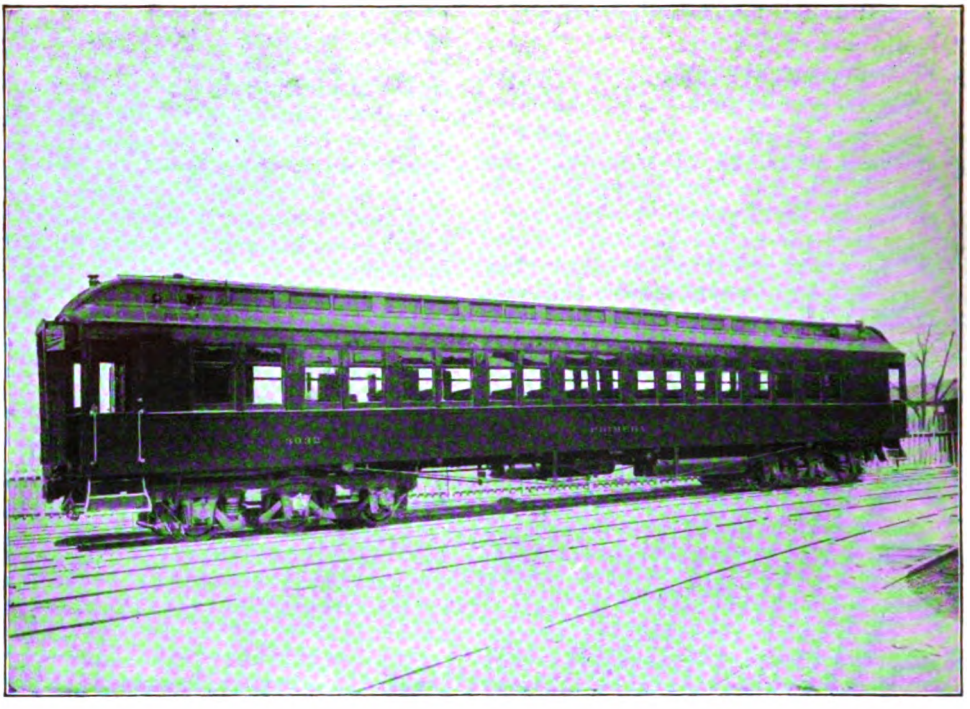
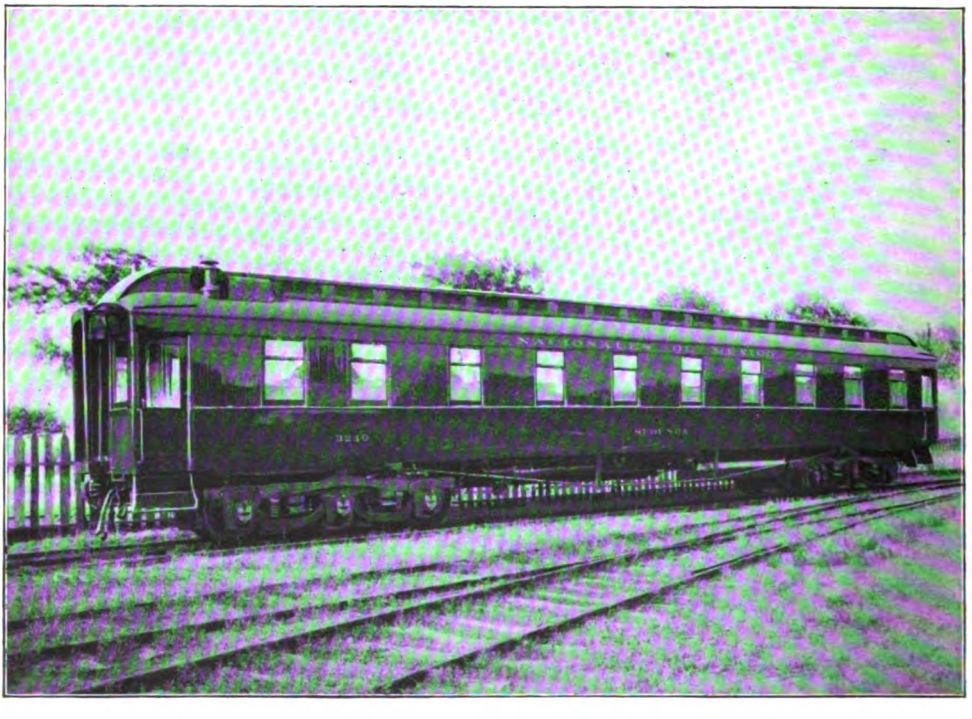


NATIONAL RAILWAYS OF MEXICO: FIRST-CLASS PASSENGER COACH.



NATIONAL RAILWAYS OF MEXICO: SECOND-CLASS PASSENGER COACH.

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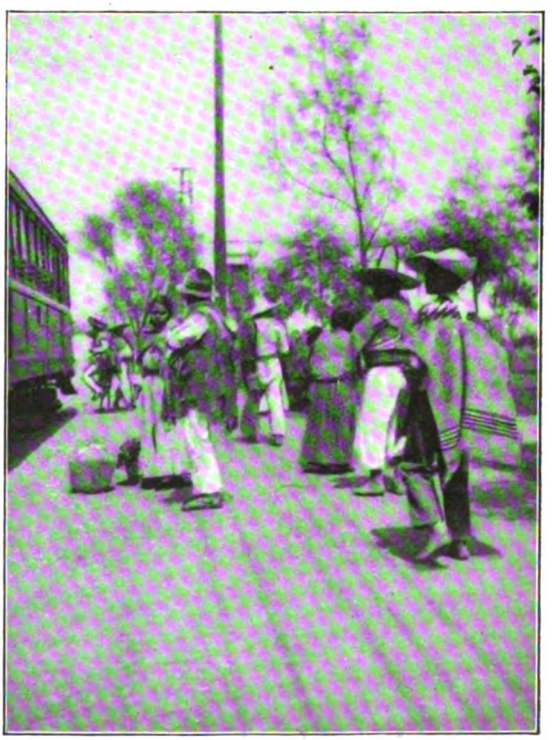
SWING BRIDGE OVER THE RIVER NEAR TAMPICO.

So rapid has been the growth of this port in late years that it is recognised urgent steps must be taken in the near future to increase the existing accommodation. With this end in view, one of the best-known British harbour-engineers has recently been out to make a general survey of the existing conditions, and to suggest where improvements may be made. His report, which we understand is now under close consideration, affirms that the River Panuco is a splendid navigable stream, being land-locked throughout, and free from strong tidal currents. It is a river easy of, or susceptible to, improvement, and with the expenditure of a

country will be opened up, and farmers will be able to market fresh produce into the largest cities not only of Mexico, but of the United States, whence there is an increasing demand. Work on this particular section is already in full swing. At a point midway between Tampico and Vera Cruz, a branch will be run out to join the existing lines at Honey, thus making a new short connection from the coast to the capital. Other extensions already started are, from Durango to Llano Grande, through a very fine timber district; from Durango to Cañitas, in the State of Zacatecas, about 230 miles in length, crossing an important agricultural and mining country; and from Rives, on the Vera Cruz and Isthmus Railway, to San Andres Tuxtla, 45 miles through the famous tobacco growing district.

Although greatly interested in the port of Vera Cruz, through the Interoceanic Railway, the National Railways, as is only natural, is chiefly concerned with the port of Tampico. It is situate about four miles up the broad and easily navigable River Panuco, is furnished with modern wharf accommodation, and possesses the most up-to-date customs house in the country. Railway tracks run right alongside the steamers, and goods can therefore be unloaded direct from their tackles into railway cars and *vice-versa*. In fact, the majority of the traffic moving through the port is handled in this manner.



A WAYSIDE STATION IN MEXICO.

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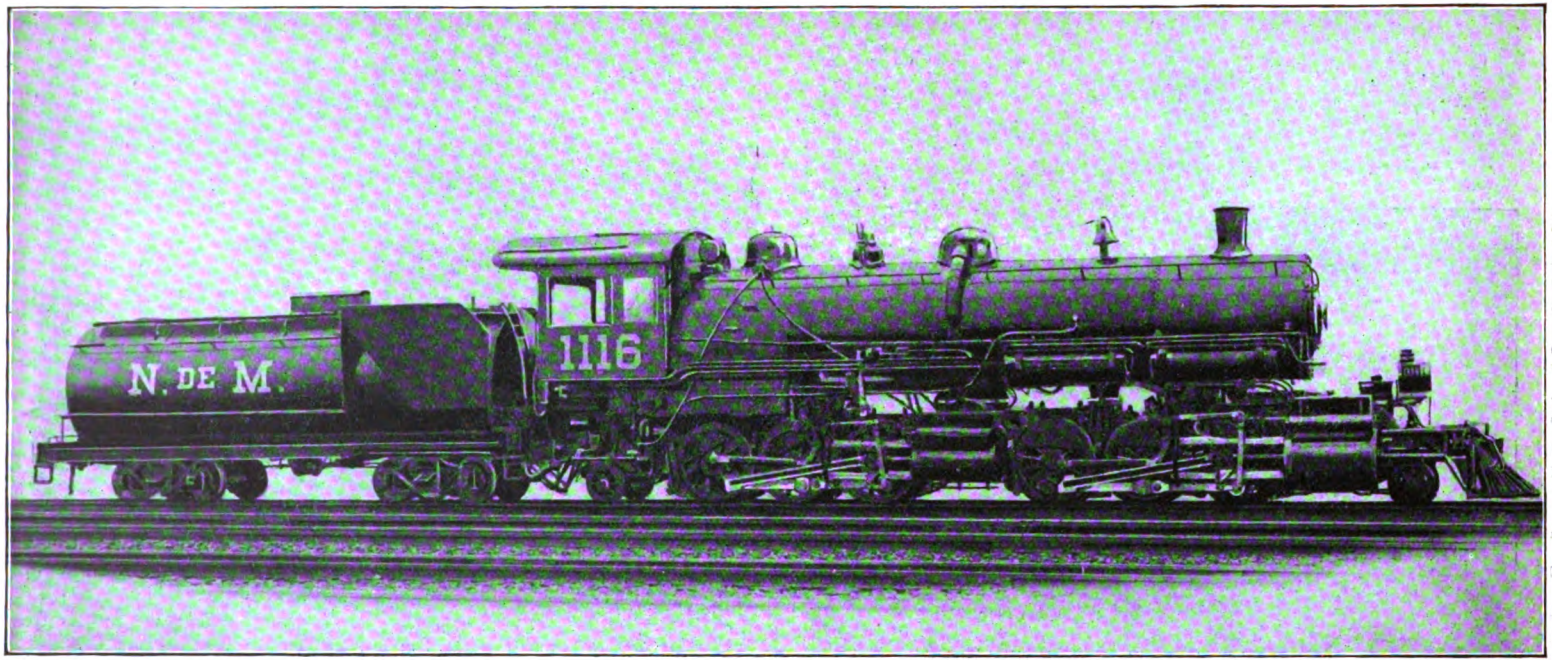

NATIONAL RAILWAYS OF MEXICO: MALLET TYPE OF GOODS ENGINE, NO. 1116.

LEADING DIMENSIONS.

Length over buffers	103 ft.
Height	16 ,,
Width	10½ ,,
Weight of Engine	151 tons
,, ,, with Tender ..	228 ,,
Weight on Drivers	134 ,,
Cylinders (high pressure)	21½ in. dia.
,, (low pressure)	33 ,, ,,

LEADING DIMENSIONS.

Stroke (high and low pressure) ..	32 in.
Diameter of Driving Wheels ..	4 ft. 8 in.
Working Steam Pressure	220 lbs.
Heating Surface of Firebox and Tubes	4,700 sq. ft.
Water Capacity of Tender ..	9,000 gals.
Oil (Fuel) Capacity of Tender ..	4,000 ,,

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comparatively small sum of money could be made a safe harbour, easy of access for steamers of the very largest size. With enormous possibilities in front of it, the oil industry of Mexico is really only in its infancy. But already 300,000 tons are handled monthly through Tampico, and new "tankers" are being built, by means of which it is anticipated the tonnage will advance to several times its present volume.

A moment's study of the map will indicate the increase in imports and exports passing through the port which is bound to follow the completion of the new short line from Tampico to Mexico City, and without doubt it will also affect the course of passenger travel.

Another growing port is Manzanillo, on the Pacific Coast of Mexico. This is considered to be one of the very finest deep-water harbours in the world, being completely sheltered on all sides, with an average depth of over 40 ft. of water, except at the extreme shore end of the pier, where there is at present 28 ft., quite sufficient for all ordinary purposes. The opening of the Panama Canal will enormously increase the traffic passing through this port. Manzanillo, as previously stated, has direct rail communication with Mexico City and Guadalajara, the two largest cities in the Republic. A new coaling plant, capable of dealing with at least 500 tons per hour, will shortly be erected.

In view of the proximity of the United States, it is natural to expect that the bulk of the rolling stock should be built in that country.

On page 62 a photograph of No. 1116, of the latest type of goods-engines, 20 of which are now at work chiefly on the heavy Tamasopa and Cuernavaca sections of the railway. As will be seen, these are Mallet articulated compound locomotives of enormous size, being, in fact, the heaviest ever brought into the Republic.

GENERAL VIEW OF WHARVES, TAMPICO.

As will be gathered from the exterior and interior views reproduced, the passenger equipment is designed according to American practice, and is of the most up-to-date and comfortable description. Photographs of the exterior and interior of the standard first-class cars are given on pages 60 and 65. In addition to these, Pullman cars of the latest type are operated on the principal trains, so that from the

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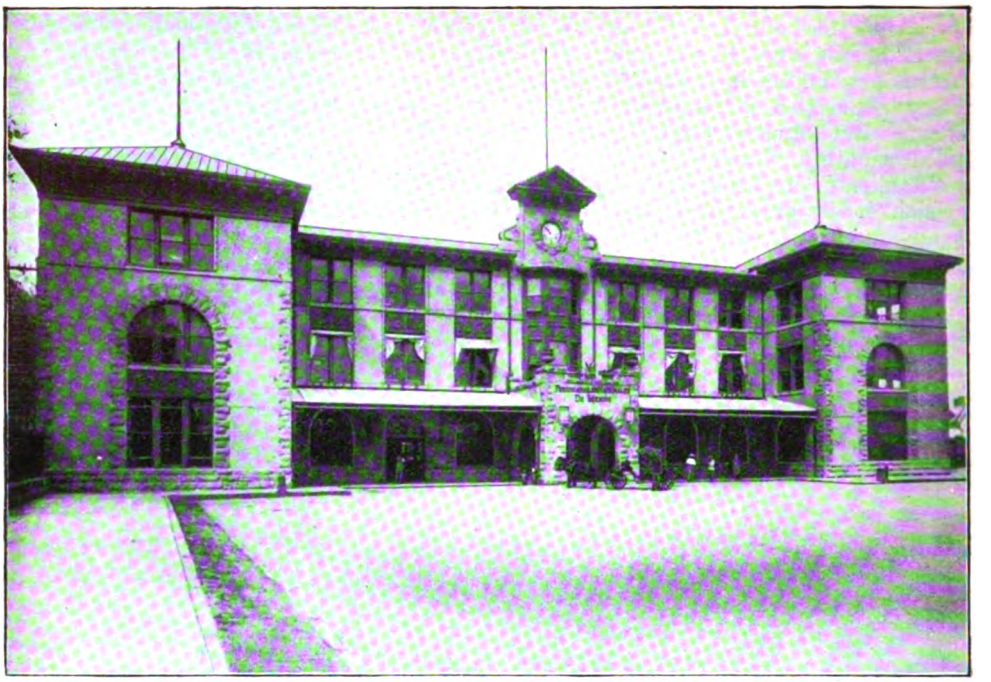

NATIONAL RAILWAYS OF MEXICO: COLONIA STATION, MEXICO CITY.

NATIONAL RAILWAYS OF MEXICO OFFICES: IN MEXICO CITY.

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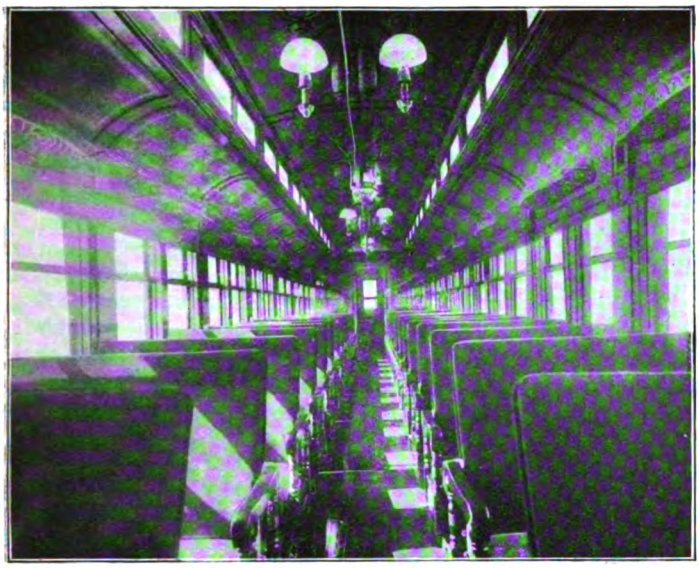


NATIONAL RAILWAYS OF MEXICO:
Interior, First-Class Passenger Coach.

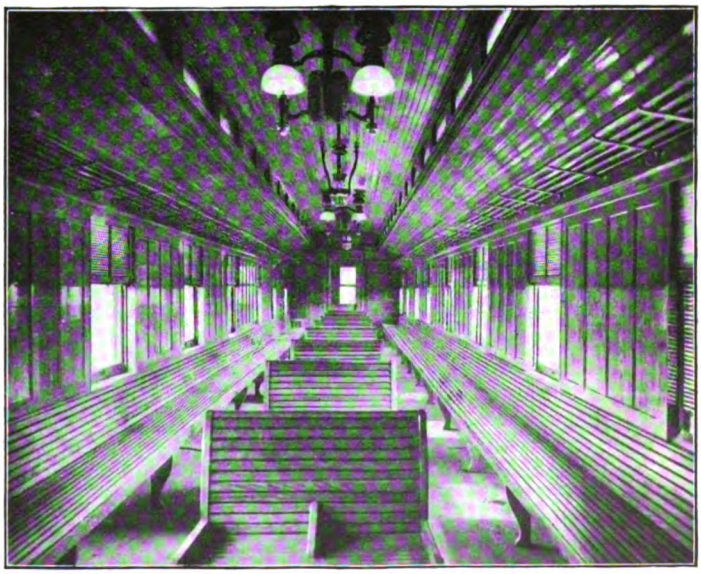
point of view of comfort the passenger is as well off in Mexico as in her northern neighbour. The latest rolling stock returns show 20,389 freight cars, 570 passenger cars, and 761 locomotives.

The track itself is well-laid, and compares favourably with that of British lines. Some 550 miles are down in 85 lb., and 1,500 in 75 lb. rails. The track generally is being gradually re-laid with the heavier metal.

Fares are universally cheap, the first-class averaging slightly less than one penny per mile, while the second-class works out at approximately half the first. In addition, excursions are arranged to the beauty spots and health resorts at considerably reduced fares. As examples, what more can one desire than first-class travel from Mexicc City to Guadalajara and back (766 miles) for 52s., or Toluca and back (92 miles) for 6s. 1d.?

The National Railways has often been described as the "barometer" of Mexico, in that its prosperity increases or decreases in the same ratio as the general prosperity of the country. Fully recognising this, the management have installed at the headquarters office, Mexico City, an industrial agent whose duty it is to do everything in his power to help new enterprises and generally to disseminate useful information. His office is stocked with statistics of all kinds, particulars of the best available sites for factories, haciendas and farm lands for sale; and, in general, he will be prepared to suggest and advise on all questions falling within the sphere indicated by his official title. This facility is, of course, available for European inquirers.

Owing to the competition between the



NATIONAL RAILWAYS OF MEXICO:
Interior of Second-Class Passenger Coach, used by peasants and emigrants.

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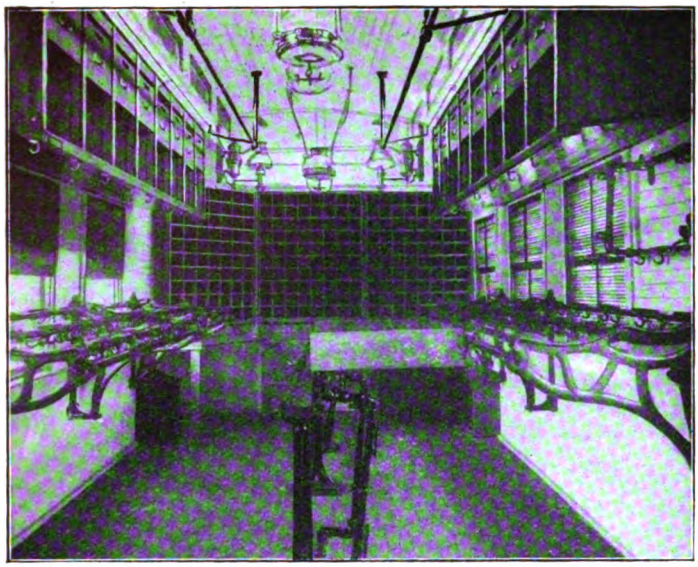
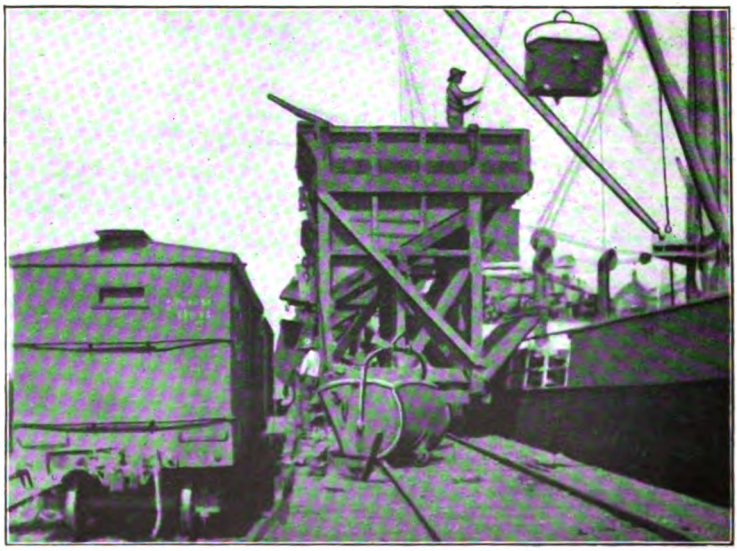


NATIONAL RAILWAYS OF MEXICO:
Interior of Mail Van.

all-rail and rail-and-water routes to Mexico from the States, and the consequent lower freight rates, European merchants have hitherto been at a disadvantage in securing business, especially for the northern districts of Mexico. Recognizing this, and as evidence of their desire to encourage European trade, the National Railways on January 1st last inaugurated a new tariff in connection with the steamship companies serving the port of Tampico. Valuable concessions in rating are given to shippers under this schedule as compared with the full local rates. The tariff is unique in Europe for the reason that, in addition to the saving in charges, all rates are stated in plain weight terms. British merchants can now enter the vast commercial field of Mexico with the assurance that they are on an equality with their American competitors, at any rate, as far as freight charges are concerned. It is the general opinion in Mexican circles that when the present troubles are at an end (and this it is anticipated cannot for long be delayed) there will be a trade "boom." It therefore behoves British merchants who desire to increase their business to formulate their plans now, so that when the time comes they may not be left behind in the race.

Owing to the geographical location of Mexico and the United States, the American trade interest in the southern Republic is of enormous importance; and to accommodate the constant stream of business men travelling backwards and forwards a splendid service of through trains is maintained. Chief among these should be mentioned the "Mexico–St. Louis" special, a train which must be counted as one of the famous expresses of the world. It leaves St. Louis at 7.30 every evening and runs direct to Mexico City in three days. It is composed of Pullman cars of the latest design,



UNLOADING COAL AT TAMPICO.

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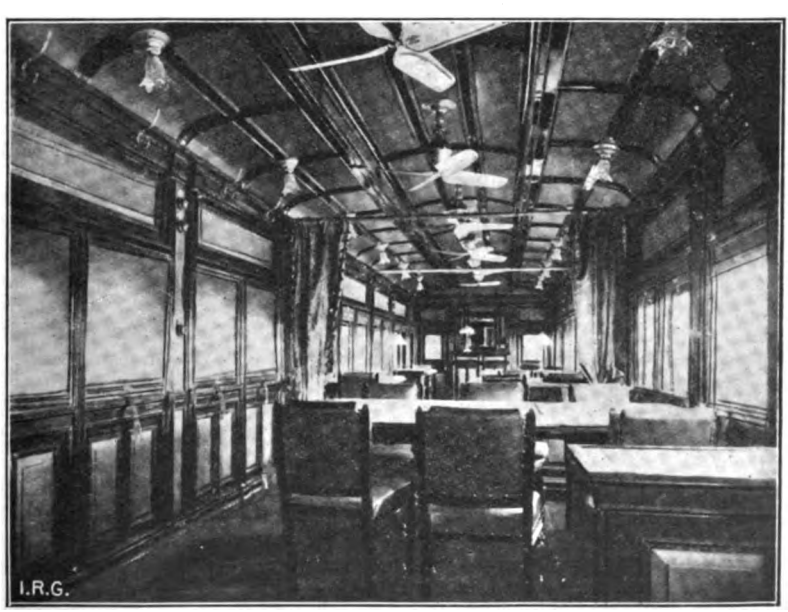
electrically lighted, with full buffet-service, and the passenger can set out satisfied that although his journey may be long and tedious, his creature comforts will be catered for in the most luxurious fashion. The National Railways take charge of the train from New Laredo at the border, hauling the 800 odd miles to destination at an average rate of, approximately, thirty miles an hour, including stops—not poor work when all the factors are taken into consideration.

From one aspect Mexico has been neglected by the British travelling public, and that is as a tourist ground. Americans have been quick to recognise the attractions of the country from this point of view, and are visiting it in greater numbers each year. The feet of tourists, however, have not yet trodden down customs and ceremonies that date back to the days of the Conquistadores, and even beyond. Progress has only added modern comforts, without destroying the charm of an age now past. No land under the sun presents such vivid contrasts—the ancient and modern side by side. From the windows of a twentieth century train you gaze upon villages that were in existence before Cortez began his memorable march to the tableland, at churches rich in decorations and paintings —the gifts of the faithful, at pyramids and ruins whose history is lost in the midst of antiquity; and yet side by side with this one can always find up-to-date hotels, where the comforts demanded by modern standards of luxury can be obtained at fairly reasonable cost.

One of the greatest attractions Mexico holds out to the traveller is her climate. Of every season of the year this is true. A well-known English journalist who recently visited the country describes it as "the most wonderful climate in the world . . . The atmosphere and temperature were an unfailing delight to me. . . . I am convinced that the people who are concerned to discover the site of the Garden of Eden ought to seek it in the latitude, and at the altitude, of Mexico City."

INDIAN STATE RAILWAYS.



THEIR IMPERIAL MAJESTY'S STATE TRAIN: THE DINING SALOON

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Photo] [*H. T. Worlock.*

LONDON AND NORTH WESTERN RAILWAY:
Up Irish Mail taking water at Bushey. Locomotive No. 2495, *Bassethound* (Schmidt superheater class).

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

FOR a second year in succession the prevailing feature of new locomotive construction on almost every line in the British Isles, either definitely or tentatively, may be said to be superheating. Every new type of tender engine introduced during 1912 is superheater-equipped, not to mention numbers also of tank locomotives intended for main line service, while several companies, besides multiplying existing types arranged for superheating, are also going to the length of rebuilding earlier types of engine with the addition of this valuable attachment. The London and North Western has up to the present been the most extensive user in this country of superheating apparatus, having nearly 200 engines so equipped; the Midland total of engines fitted, or in course of being fitted, is not far short of 100; while the number on the Great Northern exceeds 50. In each of these cases the Schmidt superheater is in use (coupled on the Midland with certain ingenious arrangements patented by Mr. H. Fowler, the Locomotive Superintendent), yielding a high degree of superheat. On the Great Western the moderate superheat afforded by the Swindon apparatus has become a permanent feature of all new construction, as also, apparently, has the Robinson pattern of superheater on the Great Central Railway. In these circumstances it would be idle to deny that the superheater has in popular parlance "come to stay," and that any extra expenses in maintenance incurred by the users are more than counterbalanced by either economies in fuel and water consumption, increased tractive power, or a combination of both desirable results.

A survey of locomotive progress during 1912 may be accompanied, as far as my collection will permit, by some records of the work of the various types of locomotives mentioned, in order to afford some evidence of the marked increment in power that has been obtained by the provision of superheating apparatus. The London and North Western Railway, having been first mentioned, shall in the present article occupy the leading position. On this line the superheater types in use—all of which have been building during 1912—are the 4–4–0 (*George the Fifth*) and 4–6–0 (*Prince of Wales*) classes of express passenger engine, in addition to 4–6–2 main line tank engines and 0–8–0 mineral engines. It is worthy of note that existing 0–8–0 engines are also being superheater-equipped. At this point it should be mentioned that the superheater

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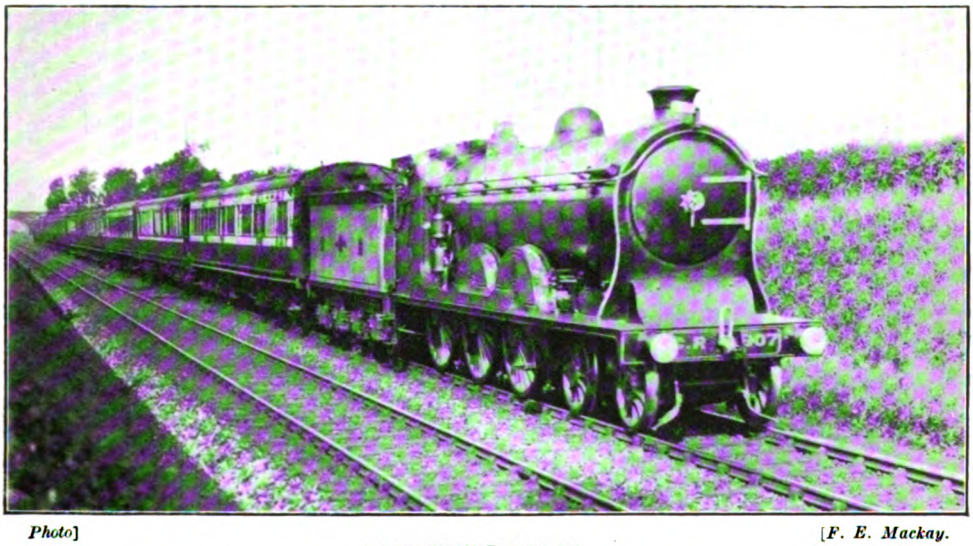
displays its principal advantages in the case of engines under continuous steam, as in these circumstances the various steam passages are maintained at the correct temperature, and the proper degree of superheat is thus secured throughout. This condition is obtained with the express locomotive and the main line goods locomotive, particularly on non-stop runs of some duration. The suburban tank locomotive, however, with its constant need for shutting off steam in view of intermediate stoppages, is not so suitable for the application of the principle. In fact, no purely suburban tank engines have been so fitted in this country. The superheater 4–4–2 tanks on the London, Brighton and South Coast Railway, 4–6–2 on the London and North Western Railway, and Great Central Railway, and 2–4–2 on the Lancashire and Yorkshire Railway, are used principally for fairly long-distance journeys.

This month, and also in next month's issue, I desire to record some further remarkably fine runs behind superheater engines on the London and North Western Railway, the principal feature of which is that, no matter what load was hauled, not a single failure to observe schedule times was recorded, irrespective of delays encountered *en route*. The runs have all, as far as I am concerned, been purely "chance" excursions, made in the course of ordinary business during the last few weeks, and in no instance have I had any communication with the drivers concerned. Each run may, therefore, be accepted as fully representative of ordinary performance. One of the pleasures of travelling by the London and North Western Railway is the real effort made by almost every driver to regain time lost by circumstances beyond his own control—either signal or permanent way delays—while the magnificent uphill work shown by the engines is also a source of the greatest interest. This will be more apparent when I deal next month with the Crewe-Carlisle records. My present runs comprise one on the 10.30 a.m. Manchester and Liverpool express, together with another on the same train kindly furnished by a correspondent, each behind superheater 4–4–0 engines two runs on the 10 a.m. down Scotch express behind locomotives of a similar type, and, for purposes of comparison, one behind a combination of a non-superheater "Experiment" and a "Precursor." I have also added, in the first column, the times of the historic run with No. 1595, *Wild Duck*, which was dealt with at length in the January and February (1912) issues of the RAILWAY MAGAZINE.



Photo] [*F. E. Mackay.*

CALEDONIAN RAILWAY:
10 a.m. Glasgow-London Express. 4–6–0 locomotive No. 907 (now fitted with Schmidt superheater).

On the first of the present series of runs we were honoured with the services of the Royal engine, No. 5000 *Coronation*, and treated to a performance in keeping with the handsome appearance of our steed. The pace out to Willesden was not "breakneck,"

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LONDON AND NORTH WESTERN RAILWAY—EUSTON TO CREWE.

Distance (Miles)	Train ex-Euston	10.30 a.m. Manchester & Liverpool.				10 a.m. Edinburgh & Glasgow.				
	Engine No. ..	Schedule Times	1595	5000	—	Distance (Miles)	Schdule Times	1733	‡1649	‖1583
	Name ..		*Wild Duck*	*Coronation*	—			*Grouse*	*Sisyphus*	*Henry Ward*
	Type ..		S 4-4-0	S 4-4-0	S 4-4-0			S 4-4-0	4-6-0	S 4-4-0
	Load (axles) ..		54	54	58			40	58	56 —
	Load (tons) ..		410	400	425			275	400	390
—	Euston ..	0	0.00	0.00	0.00	0	0	0.00	0.00	0.00
			a							
1¼	Chalk Farm ..	—	13.20	5.00	3.50	1¼	—	4.10	3 45	3.30
5½	Willesden Jc. ..	9	19.55	11.15	8.55	5½	9	10.30	9.50	9.35
11⅜	Harrow ..	—	26.30	17.45	—	5⅞	—	8.30	8.20	8.55
17½	Watford ..	23	32.55	24.10	22.00	12	15	15.05	15.00	15.30
24¼	Boxmoor ..	—	40.05	31.20	—	19	—	22.15	22.20	22.45
31⅝	Tring ..	40	47.40	38.55	37.25	26⅛	31	30.35	30.25	31.00
40⅛	Leighton ..	—	54.50	46.15	45.00	34⅝	—	38.05	38.00	38.45
46⅝	Bletchley ..	55	60.10	51.45	50.30	41⅛	46	44.00	43.30	44.40
52⅜	Wolverton ..	—	64.50	56.45	55.35	46⅞	—	49.25	48.30	50.10
								c		
59¾	Roade ..	68	71.40	64.35	63.10	54¼	60	66.00	55.50	58.20
62¾	Blisworth ..	—	74.35	68.00	66.15	57¼	—	69.55	58.55	62.00
				b				b	b	b
69½	Weedon ..	—	80.50	75.15	—	64¼	—	77.30	66.15	69.20
75¼	Welton ..	—	86.15	82.35	—	69¾	—	85.30	74.40	76.50
									c	c
82⅝	Rugby* ..	91	93.30	90.20	86.50	77⅛	85	93.50	84.25	86.40
88	Brinklow ..	—	100.20	96.40	93.40	5⅜	—	7.45	8.45	8.40
									d	e
97	Nuneaton ..	107	109.00	105.55	102.50	14⅜	17	16.25	21.45	18.05
										f
102¾	Atherstone ..	—	113.25	111.10	—	20⅛	—	20.50	27.30	26.35
110	Tamworth ..	119	119.50	118.20	114.30	27⅜	30	27.15	34.15	33.45
116½	Lichfield ..	—	125.20	124.35	—	33⅞	—	33.00	40.05	39.20
124¼	Rugeley ..	133	132.55	133.05	128.15	41⅝	45	41.40	47.50	47.10
133½	Stafford† ..	143	142.15	142.45	138.05	50⅞	55	52.10	57.05	56.30
139⅞	Norton Bridge	149	148.40	148.45	144.35	56¼	61	59.10	63.00	62.40
147½	Whitmore ..	—	157.55	159.00	154.10	64⅞	—	69.00	71.25	72.10
156	Mile-post 156 ..	—	165.40	167.35	—	73⅜	—	77.20	78.55	80.05
			h						g	
158	Crewe ..	171	170.45	170.35	165.10	75⅜	84	80.35	82.50	83.35

The thick horizontal line indicates booked stop.

S Superheater engine. ‡ Pilot throughout: 4-4-0 1363 *Brindley* ‖ Pilot to Willesden: $\frac{4\text{-}4\text{-}2}{T}$ 1764

*Service slack: 30 miles per hour. † Service slack: 40 miles per hour.

a Dead stand on Camden Bank, 5 min. b Permanent way slack, Weedon. c Dead stop (twice) Roade signals. d Dead slow, Nuneaton signals. e Severe signal check, Nuneaton. f Dead slow, Atherstone signals. g Signal check outside Crewe. h Dead slow, Crewe home signal.

but a 1 in 70 bank at the start is not altogether the easiest ascent up which to accelerate with a 400-ton train load. Willesden was thus passed 2¼ min. behind time. Magnificent work followed up the long rise to Tring, showing a fractional improvement even on the record flight of *Wild Duck*. With minima of 54·2 miles per hour at Pinner and 55·6 at the summit, Tring was passed more than a minute before time. That is, the 26⅛-mile uphill stretch from Willesden to Tring had been covered in 27 min. 40 sec., with this heavy load, or more than 3¼ min. under the 31 min. booking. A maximum speed of 58·4 miles per hour was touched at Willesden, and a further one of 62·5 at Watford. Down the succeeding incline a maximum rate of 76·3 miles per hour was maintained for some distance, taking us through Bletchley 3¼ min. early. The time had evidently now come for some moderation of the speed, and our driver chose what may be taken as the regulation length for so doing—the ascent from Castlethorpe troughs to Roade, on which speed fell to 48·4 miles per hour, although even

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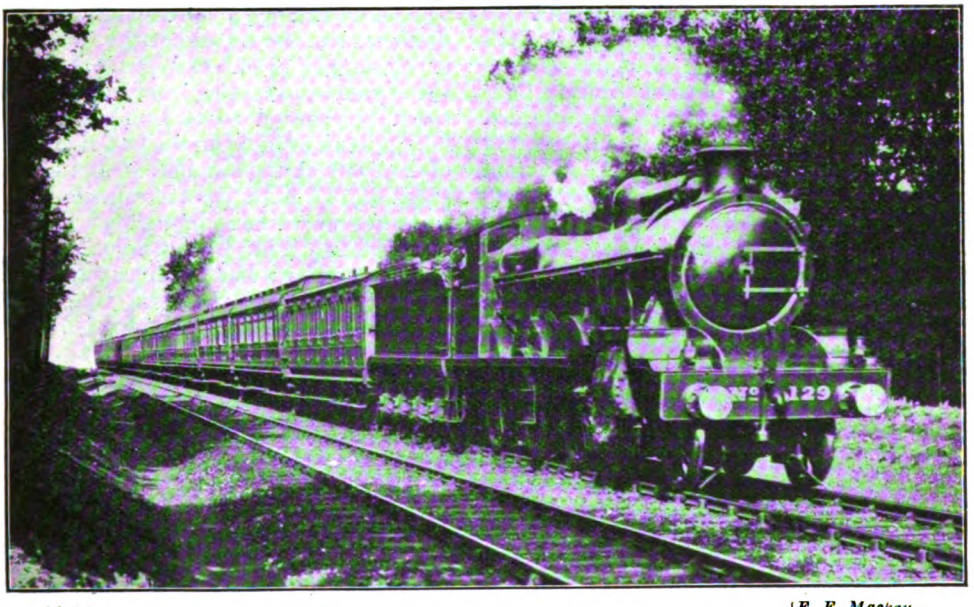
then we were still keeping time. Following came a severe slack for underline permanent way operations at Weedon, which very nearly consumed all our "spare" time, although we still had a fraction of a minute in hand at Rugby. The acceleration from Rugby was again a noteworthy feature, the times to Brinklow showing a perceptible improvement on those of *Wild Duck*. But from that point onwards a rising side-wind began to make its presence felt rather keenly, and so forbade any further substantial gains on schedule. Past Nuneaton the highest speed touched was only 69·2 miles per hour, while the minimum speed at Whitmore was 47·9 miles per hour, these being the most pronounced extremes. But with a close adherence to booked times and an unchecked run, we just contrived to arrive at Crewe on booked time.

My correspondent's run, which appears in the next column, exhibits several features of uncommon interest, chief among which are the load and the time taken for the start to Willesden. In comparison with the other times, the latter leads me to wonder whether the train was "banked" in the rear as far as Chalk Farm without my friend being aware of it. Even then, however, the time from Chalk Farm to Willesden was exceptionally fine, while 8 min. 55 sec. out to Willesden unassisted with 425 tons—if this were the case—is phenomenal. A mile-a-minute was touched through Willesden, but the running thence to Tring, although very good, was not quite up to the level of that on the preceding journeys. The minima at Pinner and Tring were both 52 miles per hour, and the maximum rate at Watford 61·4 miles per hour. Down the bank to Bletchley a top speed of 76·3 miles per hour was again touched, yielding an unusual time (with such a load) of 50½ min. from Euston to this point.

Immediately afterwards followed a slight "easing up" to Roade, with a minimum of 53·5 miles per hour at the summit, while the succeeding length to Rugby with a maximum speed of 64·3 miles per hour at Weedon, and a minimum of 53 miles per hour at Kilsby Tunnel, was not "rushed." However, as my correspondent points out, the compilers of the London-Birmingham 2-hour times probably did not contemplate trains of 425 tons weight observing them to Rugby single-headed, as was done in this case. Thenceforward, although further time was gained, the acquisitions were more moderate. A maximum speed of 72·5 miles per hour at Tamworth was succeeded by a minimum of 56·3 beyond Lichfield; the minimum speed at Whitmore was 53 miles per hour, and the maximum on the descent



Photo] [*F. E. Mackay.*

GLASGOW AND SOUTH WESTERN RAILWAY:
9.20 a.m. Glasgow-London Express. 4-6-0 Locomotive No. 129 (fitted with Schmidt Superheater).

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to Crewe 72·5 miles per hour, the train running in with a modest total of nearly 6 min. in hand. Magnificent though this run was, it exhibits no improvement at any point north of Willesden on the *Wild Duck* times in the first column, while more promise was shown on certain lengths by *Coronation*, even though the start in the latter and the total times were inferior. My friend unfortunately omitted to note the number and name of his engine, but from memory he believes it to have been one of the "Hound" series.

The first of the runs with the 10 a.m. down Scotch express—in this case running in duplicate—displays, owing to the comparatively light load, no very particular merit south of Rugby. Time was well in hand at Bletchley, but two dead stands for signals just before Roade, followed by the Weedon engineer's slack, brought us into Rugby substantially behind time. Consequently a start nearly 10 min. late afforded the driver a good opportunity of showing off the powers of his steed. This he did from the start in no uncertain fashion, accelerating up grades principally rising to exactly 60 miles per hour, and passing Shilton, near the summit (8⅝ miles from Rugby), in exactly 11 min. Through Nuneaton 75 miles per hour was the highest speed recorded, settling down to a steady 73·8 beyond. This also was the sustained speed in the neighbourhood of Tamworth, "even time" from the start being thus made and improved upon. Beyond Lichfield, however, a most unaccountable deceleration occurred, as though the driver had repented of making up any lost time, and he proceeded to lose a further 1½ min. between that point and Norton Bridge. Some fairly smart running into Crewe completed the run. The minimum speed at Whitmore was as high as 54·2 miles per hour, and Crewe was reached with an economy of nearly 3½ min. on the booking from Rugby. Fortunately for me, some time was thus left to be made up north of Crewe, of which more in next month's article.

In the next column there is a double-headed non-superheater run, the chief point of which is that it shows uphill work little superior to that of the superheater engine in the last column, which was unpiloted. The start to Willesden was smart, as also was the one from that point, 48½ min. to Wolverton being quite a brisk time for the 46⅞ miles from Willesden. At Tring the minimum speed was 53·8 miles per hour, and beyond Cheddington 75 miles per hour was recorded. The same permanent way check at Weedon still left us plenty of time for an early arrival at Rugby, had we not also experienced a severe signal check at Hillmorton. Even then, however, we were 35 sec. within the booked allowance, giving a net time of about 80 min. from Willesden. From Rugby a fair start was made, but between Bulkington and Nuneaton we were brought to almost a dead stand for signals, and so passed that town 4¾ min. late, at a very low rate of speed. This check called forth a really remarkable effort from the two drivers, the 59 miles from Nuneaton to mile-post 156, including Stafford slack, being covered in 57 min. 10 sec. A maximum speed of 70·3 miles per hour at Tamworth was succeeded by a fairly high average to Stafford, but the feature of the run was the extraordinary ascent to Whitmore. On the rising grades, averaging from 1 in 505 to 590, speed accelerated to 63·4 miles per hour, falling to an even 60 on the last short length of 1 in 391 at the summit. Our maximum speed of 77·5 miles per hour on the descent to Crewe would have brought us in to that town in 24¾ min. from Stafford, had the road been clear; but the time was 25¾ min. I should estimate the total time for the 75⅜ miles from Rugby at about 76½ min. net.

The last run showed fine work throughout, considering what was the load, but particularly beyond Rugby. Utilising the services of an "Atlantic" tank as pilot to Willesden, Camden bank was "rushed" in smart time, bringing us within measurable distance of the tight 9 min. allowed to Willesden stop. The start out to Tring, accomplished exactly in booked time, was good, although the minimum speed at the summit—52·3 miles per hour—was not quite up to the previous standards. But the descent to Bletchley and the ascent to Roade were much more moderate, the maximum and minimum speeds respectively being 72·5 and 45 miles per hour. Weedon furnished the same check, but there was still time left for a punctual arrival in Rugby, had not a further severe signal check been encountered at Hillmorton. Beyond Rugby, however, the driver made a brilliant effort. Accelerating rapidly, Shilton was passed in exactly 12 min., but there then followed a signal check at the same cabin before Nuneaton, together with a very much worse one after passing that town. However, we managed to attain a top speed of 72·5 miles

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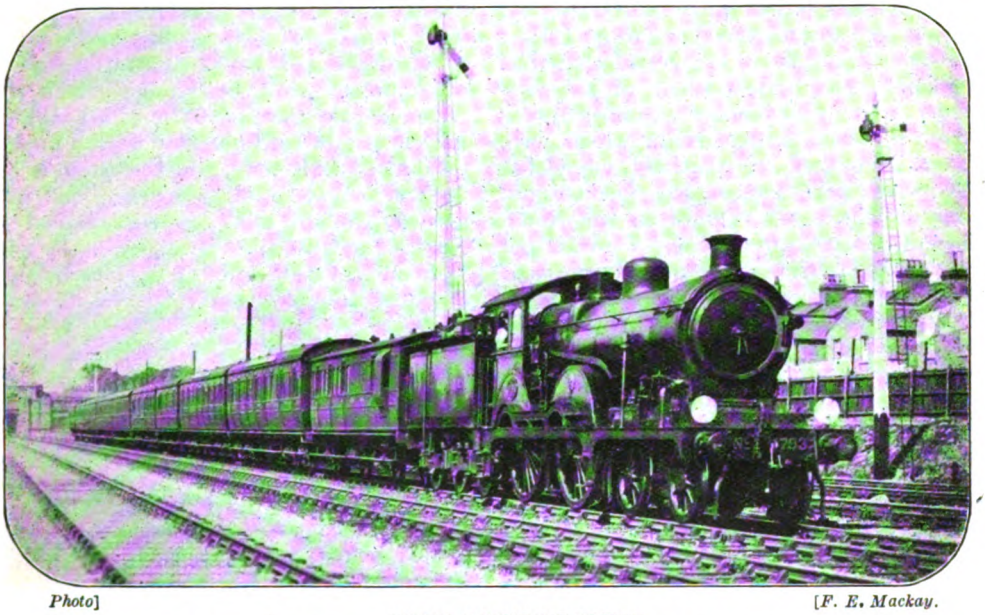
per hour at Tamworth, and to maintain a speed only fractionally inferior to that of the previous run from Lichfield to Stafford. We were unable to repeat the paragon performance to Whitmore, although recovering smartly to Norton Bridge. On the incline our speed fell to 52·9 miles per hour, rising again to 76·3 miles per hour before we slacked for Crewe. On this journey the net time may be put down as about 78 min. from Rugby to Crewe. The runs to appear in the RAILWAY MAGAZINE next month bear similar testimony to the increment of power that the addition of superheating has afforded both to the "Precursor" and the "Experiment" types on the London and North Western Railway, in the same ratio, indeed, as the advance which the latter types yielded on any that had preceded them. If the new 4–6–0 engines now building, with their four 16 in. by 26 in. cylinders and a steam producing capacity to correspond display a like increased tractive capacity, we may expect to witness on this line some phenomenal feats of haulage in the future.

On the Midland Railway—the second line mentioned at the beginning of the article—superheating has altogether "carried the day," and it is stated that the compound principle will not be carried further, so much greater comparative economies in working having been effected by the superheater engines as to render unjustifiable the expense of compound locomotive construction. At the same time, one would be interested to observe the behaviour of some of the existing 4–4–0 "Deeley" compound express engines if superheated. About 80 locomotives have already been or will shortly be turned out of Derby works equipped with superheaters. These comprise 30 new 0–6–0 goods locomotives and 50 re-built 4–4–0 express passenger, for a number of which, by the way, this operation represents a second complete re-building. I have had only one recent experience behind a Midland 4–4–0 superheater engine, which, although on a slow train, was significant. The locomotive was No. 502, but the load only 130 tons. Starting from Wellingborough, the 2¼ miles to Irchester, almost entirely uphill, were covered start-to-stop in 4 min. 10 sec. From Irchester an acceleration to 37·5 miles per hour up a continuous 3-mile grade of 1 in 119 was recorded, Sharnbrook, 6 miles, being reached in 9 min. 32 sec. From this station the falling start yielded a smart run to Oakley, the 3¾ miles occupying 1 sec. over 5 min., start-to-stop, while the last 3¾ miles into Bedford, with an intermediate slack, were covered in 5 min. 25 sec. From Bedford to Flitwick the work performed was less noteworthy, although here again the line is almost entirely rising. With an



Photo] [*F. E. Mackay.*

GREAT EASTERN RAILWAY.
Down Cromer and Sheringham Express. Superheater Locomotive No. 1793.

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increased load of 165 tons the 9½ miles took 12 min. 50 sec. The work up the 1 in 200 incline thence to Toddington was brisk. Luton, 10 miles, being reached in 14 min. 3 sec. from Flitwick. A good start from Luton resulted in St. Albans, 10¼ miles distant, being passed in 12 min. 29 sec., and Radlett, 15 miles, in 16 min. 44 sec.; but a signal stop at Elstree concluded the merit of the run, the start-to-stop time for the 17¾ miles from Luton being one of 21 min. 9 sec., after a very slow approach to the former station.

Current Great Northern Railway practice was dealt with at such length in last month's issue as to render further remarks in the present number unnecessary. The Great Northern Railway belongs to the select circle of lines which have introduced an entirely new locomotive type during 1912—the superheater 2–6–0 engines of class H2. Curiously enough, the whole of the passenger and express passenger engines of new types or wheel arrangements which were either introduced or partially completed last year were six-coupled locomotives. They are the 4–6–0 engines on the North Eastern, Great Eastern, Great Central, and London and North Western Railways, and the 2–6–0 engines just mentioned on the Great Northern Railway. Two lines which have hitherto used 4–4–2 type tank engines for express passenger service are experimenting with 6-coupled tanks—the London, Brighton and South Coast Railway, with the two large 4–6–2 tanks 325 *Abergavenny* and 326 *Bessborough*, and the London, Tilbury and Southend section of the Midland Railway, with heavy 4–6–4 engines, the performances of which will be closely watched. Each one of these engines is superheater-fitted, the Schmidt being employed except in the case of the Great Central and North Eastern Railways, which are both using the very similar Robinson pattern.

The Great Eastern Railway has now nine locomotives fitted with superheaters, including the five large 4–6–0 engines—the work of which has been successful beyond all expectations—in addition to four 4–4–0 engines of the "Claud Hamilton" type, two of which—Nos. 1793 and 1974—have the Schmidt apparatus, and the other two—Nos. 1798 and 1799—the Swindon pattern. The six-coupled engines are performing hitherto unheard-of feats, times of 27 and 26 min. out to Shenfield becoming quite common with theheavy Hook of Holland boat express, whereas 29 min. previously expressed about the limit effort of the "Claud Hamilton" type with any load at all exceptional. With a load of 331 tons the pioneer engine, No. 1500, maintained an average speed of 57·8 miles per hour from Chadwell Heath to Shenfield, which includes, beside a generally rising grade, an incline of 3 miles, at an average of rather steeper than 1 in 90. On the steepest part of this ascent, a grade of 1 in 84, the minimum speed was 46·5 miles per hour—a truly phenomenal figure. In this case, the time taken to Parkeston was 75 min. for the 68¾ miles, giving an average of 55 miles per hour, although the journey, heavily graded throughout, includes no fewer than four service slacks—to 30, 40, and 15 miles an hour at Chelmsford, Colchester and Manningtree respectively (all when running at high speed), and another to 20 miles per hour at Stratford when getting away from the terminus. It is also recorded that the new 82 min, schedule to Parkeston has been observed with a modest total load of 440 tons, if further proof of the tractive capacity of the new type were needed, while 7 min. has been gained by No. 1502 on a 93 min. schedule from Ipswich to London, with a train of 74 axles, or fully 500 tons, despite several intermediate signal checks.

My own experiences of late, though not startling, gave evidence of very fine locomotive work. With No. 1501, driven by Finch, and a load of 290 tons, on the 1.30 p.m. winter (Saturday) express *ex*-Liverpool Street, my previous records had all gone "by the board" at the time we reached Stratford, which was passed in 7¼ min. from the start. This initial 4-mile stretch includes a ¾-mile climb at 1 in 73 shortly after the start, followed by a level length on which we accelerated to within a fraction of 50 miles per hour before slacking for Stratford station. After Forest Gate, however, we encountered a string of very severe signal checks, which continued to Brentwood, evidently from the preceding 1.23 p.m. Southend express. But a point of moment is that the engine accelerated without difficulty after Brentwood bank box check to 28·2 miles per hour on the 1 in 93, and 27 miles per hour on the 1 in 84 beyond that at Brentwood station. Doubtless something better could have been done, but for the fear of running into further signals. As it was we passed Shenfield nearly 6 min. late, having started 1 min. after time, and lost over 6 min. by signal checks from Stratford.

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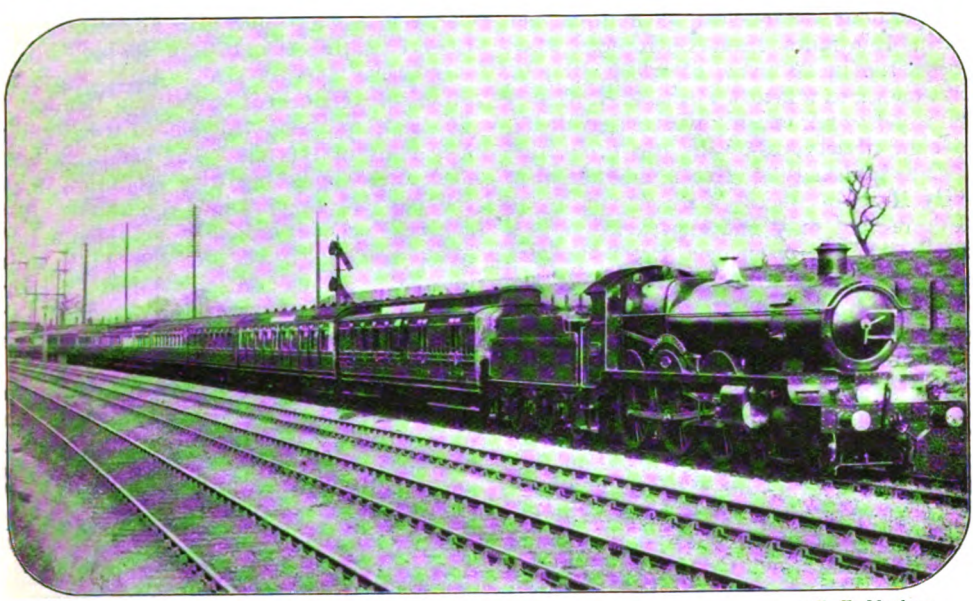
From Shenfield onwards we had a clear road, but driver Finch was content, almost all the way, to work on the first notch of his regulator, travelling under easy steam, and yet gaining from 1¼ to 2¼ min. on each section. The 9½ miles from Shenfield to Chelmsford took 9 min. 43 sec., with a maximum speed of 65·2 miles per hour, and a cautious slack through the county town. On the undulating grades through Hatfield Peverel we were again running at 65·2 miles per hour, followed by a spurt to 69·2 through Witham. On the 2 miles up, averaging 1 in 222 beyond Kelvedon, we fell to 52·9 miles per hour, but the speed rose to 68·1 miles per hour approaching Colchester, which was passed, again at a cautious speed, in 23 min. 6 sec. from Chelmsford (22 miles). On the Parson's Heath bank, averaging 1 in 138, we accelerated to 47·4 miles per hour, and further to 67 on the descent to Manningtree. Time, being now well in hand, no effort was made on the ascent to Belstead box, averaging about 3 miles at 1 in 153, on which the speed fell to 40 miles per hour. So accurately, however, had driver Finch gauged his time that, with all this easy running, we stopped dead in Ipswich platform within 2 sec. of our exact arrival time, having gained 6¾ min. from Shenfield, and run from Colchester, 17 miles, in 20 min. 31 sec. Coupling this with the 1¾-min. gain to Stratford we have a total increment of 7½ min., giving a net time of 80½ min. for the 68¾ miles from Liverpool Street to Ipswich.

On the return journey I selected a stopping train, to try the work of the engines with a heavier load. The 3.30 p.m. *ex*-Ipswich, on which I travelled, is booked to take 36 axles from Ipswich, 47 from Colchester, and 54 from Mark's Tey. In this case, the engine was No. 1502, driven by Beeston. With 220 tons behind the tender, speed rose on the 2½ miles of 120–130 (to Belstead box) to 38·8 miles per hour, and was still increasing when we topped the summit. An easy descent into Manningtree completed the 9¼ miles in 13 min. 29 sec. against 15 min. booked. On the 2½ miles at 1 in 134 from Manningtree start we accelerated to 39·1 miles per hour, the 3½ miles to Ardleigh stop taking 6 min. 49 sec., although allowed 8 min. The 4¼ miles thence into Colchester were covered exactly in the booked time of 7 min. Here our load was increased to 295 tons, but most unfortunately we had also to take a pilot which was working up to London, thereby spoiling much of the interest of the run. The assistant engine was No. 1823, of the Belpaire "Claud Hamilton" type, driven by Cage, whose name has often figured in these columns. The 5 miles to Mark's Tey,



Photo] [*F. E. Mackay.*

GREAT WESTERN RAILWAY:
3.30 p.m. Down West of England Express. Superheater Locomotive No. 4037, *Queen Philippa.*

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principally rising, took 8 min. 22 sec., although booked 9 min., and here the load was made up to 340 tons. Mark's Tey to Kelvedon, 4⅜ miles, occupied 7 min. 55 sec. (with an intermediate permanent way check), Kelvedon to Witham, 3⅝ miles, 6 min. 35 sec., and Witham to Chelmsford, 9 miles, 12 min. 23 sec., against start-to-stop bookings in each case of 8, 7, and 14 min. respectively. Beyond Chelmsford fine work was performed, even for two engines. An acceleration to 54·2 miles per hour was recorded on the rising grades to Ingatestone —nearly all between 1 in 200 and 1 in 300 in steepness—while the final ascent to Ingrave, of which the steepest section is at 1 in 110, brought us to 47·4 miles per hour. Down Brentwood bank a top speed of 75 miles per hour was touched, so that Chadwell Heath, 19¾ miles from Chelmsford start was passed in 23 min., of which 13 min. 5 sec. had been taken to Chelmsford. Delays then supervened, causing a late arrival, but the sum of gains on schedule time from Ipswich to Chadwell Heath amounted to nearly 10 min.

I have had only one experience with a superheater 4–4–0 on the Great Eastern Railway, the engine in this case being No. 1799, with the Swindon apparatus, and the train the 10 a.m. summer express from London to Felixstowe and Lowestoft, loaded moderately to a total of 190 tons. Starting well, we were severely checked at Stratford for signals; but, recovering smartly, observed the 13-min. booking from Chadwell Heath to Shenfield, our speed falling only to 34·1 miles per hour on Brentwood Bank. Consequently we passed Shenfield in 29 min. 25 sec. from the start. On the falling grades to Chelmsford the speed was the highest I have ever recorded there, touching 75 miles per hour, so that this 9½ miles was covered in 8 min. 35 sec.; but a dead slack for signals at Hatfield Peverel prevented any such "lightning" time on to Witham. The 13 miles from Witham to Colchester were, however, easily covered in 13 min. 14 sec., and the 7¾ miles on to Manningtree in a further 8 min. 32 sec., with a maximum speed over the viaducts of 71·4 miles per hour. Thus a gain of 4 min. 40 sec. on "Norfolk Coast" times had been achieved between Shenfield and Manningtree, excepting the Chelmsford-Witham section, and time being now so well in hand, it was no surprise that the driver took things very easily on to Ipswich, the last 9¼ miles taking 11 min. 40 sec.

Our times from London to Colchester and Ipswich were thus 61 min. 38 sec., and 81 min. 50 sec. respectively, although the net times did not exceed 59¼ and 79½ min. at the very most for the 51¾ and 68¾ miles. A severe slack was in force through Ipswich for the widening works, as far as East Suffolk Junction, giving us little help in the climbing of Westerfield bank, so that the last 3½ miles to Westerfield stop occupied 6 min. 52 sec., giving a total time of 87 min. 42 sec. from London inclusive—85½ min. net. To Ipswich by this train 85 min. is the booked allowance. After Westerfield, with a load of but 80 tons, the running was devoid of interest. The 18⅞ miles to Saxmundham took 24 min. 6 sec.; the 18⅛ miles thence to Beccles, with a very severe permanent way check beyond Brampton, 21 min. 56 sec.; and the last 8½ miles into Lowestoft, with three signal checks, 15 min. 35 sec., all intermediate service slacks being carefully observed. Our actual time from London to Lowestoft was thus 151 min. 51 sec., against a booking of 156 min. The net time, however, was something like 145 min., while the possible time, which could have been achieved without difficulty, provided a clear road, was 2¼ hours for the 117¾ miles journey. Thus on the Great Eastern Railway the superheater engines are acquitting themselves with the greatest credit.

I must now deal very briefly with a run over the Border as illustrating the progress of superheating in Scotland. One record of the work of No. 129, the fearsome Glasgow and South Western Railway 4–6–0 with superheater, and feed-water heater in addition placed astride the boiler, has already appeared in these pages, but this run showed, if anything, a further improvement. The train was the 7·58 p.m. *ex*-Carlisle, and the load a light one of 165 tons. Starting late from Carlisle, Gretna, 8½ miles out was passed in 11 min. 10 sec., with a slight slack for the junction, and Annan, 17½ miles, in 20¼ min., speed rising to 66·2 miles per hour as we approached that town. At Ruthwell the minimum was 60 miles per hour, and a further maximum of 72·5 was recorded past Racks, which was passed in 31 min. 20 sec. from the start (29¼ miles). The conditional stop was made at Dumfries, this 33 miles having been covered in 35 min. 40 sec., although the schedule allows 38 min. to pass. An adverse grade, almost unbroken, extends from Dumfries for a distance of nearly 32 miles to New Cumnock. Of this, 15 miles are at grades for 1 in

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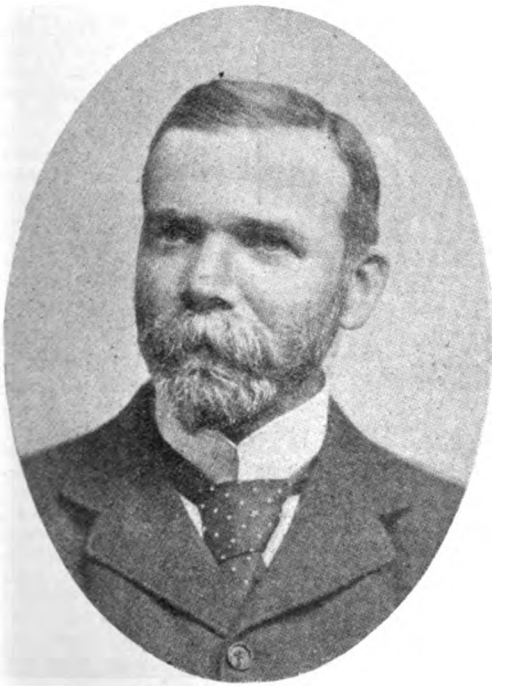
148 to 1 in 200; and the only relief is a slight 4-mile descent near Carronbridge. Yet Thornhill, 14¼ miles from Dumfries, was passed in 17 min. 25 sec., a speed averaging from 54·4 to 56·3 miles per hour being maintained up the incline. On the Carronbridge descent, a maximum of 66·2 miles per hour was touched, by the aid of which the last portion of the climb to New Cumnock was "rushed." From Dumfries to this point, 37 miles, the time was 40 min. 55 sec., whereas the schedule from *passing* Dumfries allows 45 min.

On the descent to Mauchline, mostly at 1 in 145 to 200, 73·8 miles per hour was reached, and on the 1 in 100 bank from Mossgiel Tunnel to Kilmarnock, 75 miles per hour, although the brakes were constantly in use to check the speed. From New Cumnock to Mauchline the 11¾ miles occupied "even time," and the 9½ miles thence into Kilmarnock 9¾ min., giving a total time of 62 min. 35 sec. for the 58¼ miles from Dumfries. The timetable allows 106 min. for the 91¼-mile non-stop run from Carlisle to Kilmarnock; but making the conditional stop at Dumfries, we had achieved the journey in 99 min. 25 sec. Fine work was performed on the 9¾-mile climb to Lugton, of which 8 miles are at 1 in 79 to 176. Even on the steepest portion the minimum speed (to which we accelerated from the start) was as high as 39·1 miles per hour. Lugton was passed in 14 min. 20 sec. from Kilmarnock, and, after a very moderate run down the steep incline beyond, we made the conditional stop at Strathbungo, 22¼ miles from Kilmarnock, in exactly 28 min—a very fine piece of work. A brief 4 min. 25 sec. served for the last 2 miles into Glasgow. Our total time from Carlisle, with one booked and two conditional stops, was 5 sec. under 2¼ hours, against the working schedule of 2 hours 22 min., which allows only for the one stop at Kilmarnock.

The neighbouring Caledonian Railway has also superheated the whole of the 6 ft. 6 in. 4–6–0 engines of the "Cardean" class, in addition to a number approaching 10 of the 4–4–0 engines. But as the only run I have yet had behind one of these was a little disappointing, I withhold a description of it until I have had an opportunity of making a few more trips. Although limitations of space have prevented me from giving details of all the runs I had desired, those now described will afford ample evidence as to why the principle of superheating is at the present time enjoying such marked popularity.



MR. R. W. URIE.

The New Chief Mechanical Engineer of the London & South Western Railway.

Mr. R. W. Urie has been appointed Chief Mechanical Engineer of the London and South Western Railway, in place of the late Mr. Dugald Drummond. For 15 years Mr. Urie has been Works Manager in charge, first, of the Nine Elms locomotive works, and later of the new works at Eastleigh, so that his appointment to succeed his late chief follows very appropriately and has given universal satisfaction among all who have been associated with him. He had considerable experience in general and hydraulic engineering prior to joining the Caledonian Railway in 1885, as general draughtsman, subsequently becoming chief draughtsman and Works Manager at St. Rollox before coming South to Nine Elms in 1897.

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The Inventor of the "Aga" Flashlight Signal.

THE Royal Swedish Academy of Sciences has this year awarded the Nobel Prize for Physics to Mr. Gustaf Dalén, M.E. Mr. Dalén was born at Stenstorp, Skaraborgs County, on November 30, 1869, and belongs to a family several members of which have attained eminence in various fields, including theology, jurisprudence and medicine. He devoted himself to technical pursuits, and in 1896 passed his examinations at the Chalmers Technical Institute in Gothenburg. His studies for another year were continued at the celebrated Eidgenössisches Polytechnicum of Zürich. Returning to Sweden, he commenced serious business as an inventor, dealing first with hot-air turbines. Mr. Dalén was then appointed to the staff of the De Laval Steam Turbine Company, and later became associated with the Swedish Carbide and Acetylene Company. While with the latter firm he developed his original gas accumulator inventions, and as a result of his work in this field was appointed, in 1906, to his present position of Chief Engineer of the Swedish Gas Accumulator Company, Ltd. Since 1909 Mr. Dalén has in addition been General Manager of the company. The invention above referred to was a modification of older systems of gas accumulators. The Swedish gas accumulator consists of a steel cylinder, filled with a porous substance soaked with acetone, and prepared with asbestos. This substance forms a system of capillary tubes, which prevent the acetylene molecules from becoming closely packed together, and thus liable to explosion. This invention paved the way for great developments in the utilisation of acetylene for automat cally controlled and operated navigation lights and signals. Acetylene gas thus stored, and known as dissolved acetylene, can be safely stored under pressure, and the provision of a generator with carbide and water is therefore rendered unnecessary. The capacity of the accumulators is very large, as they can hold a quantity of gas equal to 100 times the volume of the receptacle itself. The gas accumulator has, however, won world-wide importance by reason of Mr. Dalén's supplementary inventions, relating to flashlight mechanisms, the so-called "sun-valve," and other accessories, and these constitute the main reason for the award of the Nobel Prize. Previously, flashing effects were produced by the light being periodically screened off. Mr. Dalén preferred to obtain the light by periodical ignition and extinction. This result is produced as follows:—The gas is led by a pipe from the gas accumulator into a small receptacle placed just below a pilot-flame and turned off by means of a valve. Pressure of the gas in the accumulator opens the valve, and the small receptacle is charged. After the holder has been charged, the valve shuts itself, and at the same moment a lever in connection with the valve opens an upper valve, which allows a small quantity of gas to pass from the receptacle to the pilot-flame. The gas is ignited, and the flame lasts for whatever length of time the flasher is adjusted for, followed by an equally adjustable dark interval. This is continued as long as there is any gas left in the accumulator. The gas-saving feature of the Dalén flasher is enhanced by the application of Dalén's patent sun-valve, which automatically cuts off the gas during daytime, but opens again at dark, or when the weather is foggy or cloudy. Mr. Dalén regulates the "sun-valve" by means of two small rods of metal having a high expansion-coefficient. Applying the physical rule that black bodies readily absorb rays of light, transforming them to heat, whereas bright bodies repel the rays of light, one of the metal rods is bright and the other is covered with soot. Ordinary variations of heat do not affect the device, as the two rods expand or contract equally, but in full daylight the sooted rod absorbs more rays of light and thus becomes somewhat warmer and at the same time somewhat bigger than the other. This difference of volume, causes movement of a lever, which then closes the gas-valve and the lamp is extinguished. In darkness, or during fog, the sooted rod ceases to be specially affected, so that the controlling lever returns to its normal position, and the gas-valve is opened. These inventions are now so far completed that lights furnished with the apparatus work without supervision for long periods, being extinguished at the break of day and relighted at nightfall, or at any time when fog or sudden darkness may require their ignition.

MR. GUSTAF DALÉN.

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PERTINENT PARAGRAPHS

The Government and the Railways.

We are strongly inclined to the belief that had the Board of Trade been content in the first instance to present the Railways Bill as it appeared at the beginning of December, it would long ago have passed both Houses of Parliament and been added to the Statute Book. But, for some inscrutable reason, it was loaded with a lot of highly controversial proposals for which neither the railway companies nor traders had ever asked, and to which general objection was taken throughout the country. For months past six or seven notices of opposition from different parts of the House of Commons have threatened the revival of that unfortunate measure; but the Government adopted the only practical course in withdrawing the Railways Bill, and substituting the single clause embodied in Railways (No. 2) Bill. This is a simple and straightforward declaration, redeeming the promise given by the Government when the companies granted the improved labour conditions which brought the strike of August, 1911, to a termination, by providing that increased expenditure so incurred shall be treated as a valid justification of increased rates. Before being laid on the table of the House of Commons the new Bill was submitted by Mr. Buxton to the principal railway companies and to representative bodies of traders interested, and it may be assumed that it will now pass without further difficulty. The clause is in the following terms:—

1. Where on a complaint with respect to any increase (within the maximum) of any rate or charge under section one of the Railway and Canal Traffic Act, 1894, the railway company proves to the satisfaction of the Railway and Canal Commissioners—

(*a*) that there has been a rise in the cost of working the railway resulting from improvements made by the company since the nineteenth day of August nineteen hundred and eleven in the conditions of employment of their staff; and

(*b*) that the whole of the particular increase of rate or charge of which complaint is made is part of an increase made for the purpose of meeting the said rise in the cost of working; and

(*c*) that the increase of rates or charges made for the purpose of meeting the rise in the cost of working is not, in the whole, greater than is reasonably required for the purpose; and

(*d*) that the proportion of the increase of rates or charges allocated to the particular traffic with respect to which the complaint is made is not unreasonable,

the Commissioners shall treat the increase of rate or charge as justified.

* * *

Insurance of Passengers' Luggage.

The Lancashire and Yorkshire Railway have arranged with the Railway Passengers' Assurance Company, commencing with the Christmas Holidays, to insure passengers' luggage against loss, theft, and in certain circumstances, damage, not only in rail transit, but to cover the whole of the period the passenger is away from home. This applies to luggage sent in advance, as well as to luggage conveyed by the same train as the passenger. That is, for 1s. a passenger can insure his baggage, irrespective of the number of packages, for £20 for as long as 15 days; three weeks, 1s. 9d. Two shillings will insure for £40 for 15 days; 3s. 6d., three weeks, and so on; the higher the premium paid the higher the insurance and more extended the period. Complaints are frequently made of luggage being interfered with, not only in transit, but while in hotels and boarding houses, and it is anticipated that the public will, when once their attention is drawn to the matter, take advantage of the arrangement, and so be able to enjoy their holiday, knowing that if their luggage be interfered with, they will be indemnified. The amounts of the premiums are certainly very small, having regard to the risks involved. We think we are correct in stating that the railway companies will not admit any liability for loss or damage to luggage in rail transit when the passenger is travelling with a free pass or privilege ticket, and this particular

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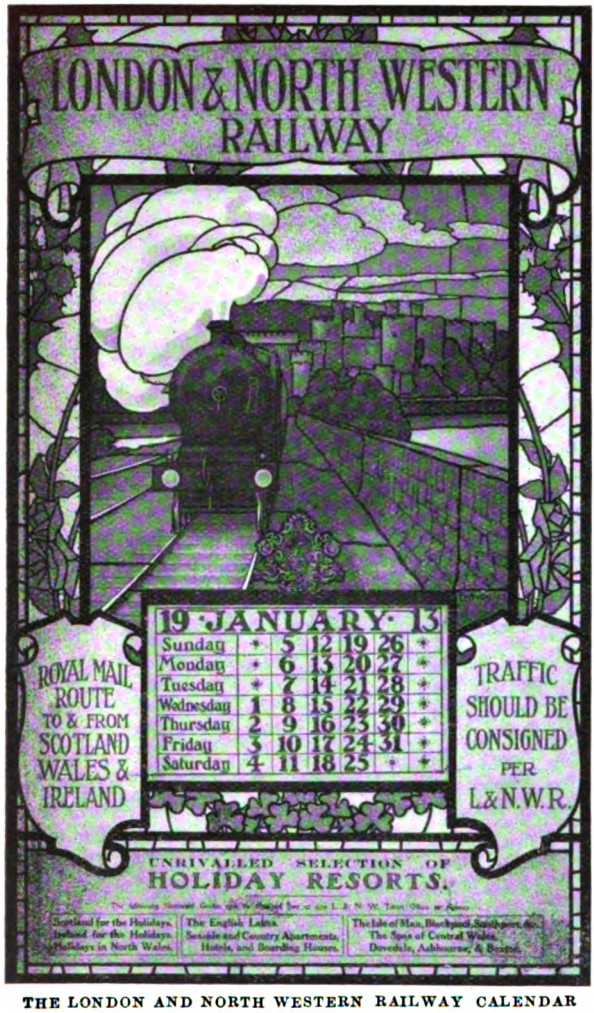
method of insurance will be a boon to such travellers, inasmuch as by payment of a small premium the owner will know that not only is his risk covered as regards his luggage from the rail transit standpoint, but also from loss and theft during the time he is in hotels or boarding houses. The initiative displayed by the Lancashire and Yorkshire Railway is to be commended, as they are the pioneers of this cheap insurance arrangement.



THE LONDON AND NORTH WESTERN RAILWAY CALENDAR FOR 1913.

The Captain and the "Railway Magazine."

We acknowledge, with sincere thanks, the following generous appreciation, published in the December issue of *The Captain*, which we commend to our youthful readers as one of the most entertaining of the Christmas illustrated magazines: "The Railway Magazine, Vol. XXX. (5s.).—That keen love of travel which is a well-known characteristic of the Britisher is well developed in readers of *The Captain*, and manifests itself, when it has no other outlet, in an eager quest for information on everything connected with railways, ships, aeroplanes, and other modes of locomotion. The latest volume of the Railway Magazine, comprising six monthly parts neatly bound in claret-coloured cloth boards, is crammed with facts of interest to such readers—descriptions of the latest types of locomotives, intimate accounts of notable stations and junctions, and interesting articles on prominent personages connected with the leading railway systems. All new departures in working methods, such as changes in systems of signalling, or in methods of issuing tickets, are lucidly explained, and one is also kept in close touch with the latest railway movements in all parts of the world. One feature alone, 'Railway Engineering and Equipment,' covers a host of diverse subjects, from railway electrification to cab signalling systems and automatic ticket machines. Several attractive coloured plates are included in this volume, in addition to hundreds of photographs of the greatest interest to every class of reader, and to those who make the study of railways and railway methods their hobby this well-edited magazine is indispensible. From the same office is issued the exceedingly useful 'Railway Year Book,' which well maintains its claim to be called 'the "Whitaker" of the railway service.'"

* * *

The New Waterloo.

By the time this issue of the Railway Magazine reaches the public, almost the last vestige will have disappeared of the original terminus of the London and South Western Railway at Waterloo. Five of the capacious platforms of the new structure have been in use for more than two years, and five more are fast approaching completion in what was formerly known as the Central Station. As the lofty modern roof is projected in successive spans from south to north the old buildings are dismantled, and the scene reveals the striking contrast between the railway practice of the past and the present. The strong steel columns upon which the girders of the superstructure rest are sunk deep into the ground, in positions where they cannot offer the least obstruction to the efficient conduct of an enormous traffic in the future. There will eventually be 23

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platforms, all connected by two subways—one for passengers changing from London and South Western to underground trains, and the other, at a lower level, for luggage, conveyed up and down by electric lifts. Consecutive numbering of the platforms has been adopted, and as all are to be approached from the concourse, which will extend from the new approach road rising out of the Lower Marsh to the carriage-way still to be built from York Road, on the north side of the property, passengers will never have the least difficulty in finding any trains they want especially as they will have the assistance of indicators fixed in conspicuous places.

* * *

Lancashire and Yorkshire Railway Technical School.

The annual report and syllabus of the evening science, art, technological, commercial and preparatory classes in connection with the Mechanics' Institute of the Lancashire and Yorkshire Railway at Horwich has been received from Mr. James T. Tatlow, hon. secretary. During the winter session of 1911-1912, 470 individual students (320 male and 150 female were enrolled as members of the classes—a decrease of 67 when compared with the preceding session. Of the 320 male students, 91 took engineering grouped courses, and 97 preliminary technical courses, the remainder being chiefly in commercial and language classes. The institute now has a membership of 2,168, and all but 57 are in the service of the company. In the library there are 10,714 volumes, as well as over 3,500 volumes of patent specifications; and in the year ended June 30, 1912, more than 26,000 books were issued, giving a daily average of 86.23 volumes. Interest in the engineering and scientific club remains undiminished, and the number of members is 150. The ambulance corps holds the Pilkington Cup this year for the fifth time, as a result of gaining second place in the Lancashire and Yorkshire Railway Company's competition at Manchester. Gymnasium, cricket, football, tennis, and rifle clubs are included on the "sports" side, and the institute maintains a brass band, which it is hoped may "soon become known favourably to a wider public." The report gives the results of the examinations last session, and also contains a catalogue of the library. Mr. J. A. F. Aspinall, the General Manager of the railway, is President of the General Committee, who are to be warmly congratulated upon the important educational work which they are conducting. In the case of the rates of subscription, persons in employment of the Company, are 1½d. per week for those in receipt of wages under 24s. per week, 2d. per week for those paid 24s. and under £3 per week, and 3d. per week for all whose earnings exceed £3 per week. Ladies and gentlemen not in the service of the Company pay quarterly fees on a higher, but yet very moderate scale, having regard to the splendid facilities and high-class training offered.

Brunswick House, London and South Western Railway.

The first smoking concert of the present eason and the annual distribution of prizes to she staff of the London and South Western Railway was an occasion of more than ordinary importance. Mr. H. A. Walker, the General Manager, presided, and in addition to two members of the Board of Directors—the Earl of Selborne and Colonel Williams, M.P.—the Company were honoured by the attendance of Mr. F. H. Dent, General Manager of the South Eastern and Chatham Railway, and Mr. A. H. Stanley, Managing Director of the London Electric Railways Company. Nearly all the chief officers were present, including Mr. Henry Holmes, Superintendent of the Line; Mr. W. Bishop, Solicitors; Mr. J. Smeal, Outdoor Goods Manager; Mr. T. F. Molyneux, London District Superintendent; Mr. J. H. Vickery, Chief Assistant to the General Manager; and Dr. T. Archer, Medical Officer. Porter Walter Charles Simmons received from the Directors a silver watch, in recognition of his bravery, in leaping from the platform of Bournemouth Central Station, to save the life of a woman who had deliberately jumped in front of an express passenger train travelling at about 25 miles an hour. The driver promptly applied the vacuum brake and sounded the whistle, but as the train was only 40 yards away when the incident occurred, it would have been impossible to avoid a calamity had not Simmons at the risk of his own life, succeeded in lifting her out of the way, when the engine was only 12 yards from the spot where she stood in the middle of the down road. We are glad to know that Mr. Walker has made representations to the King, and we have little doubt that Simmons will ere long be summoned to receive the Albert Medal at the hands of his Majesty. Another pleasing incident of the evening was the presentation of prizes for ambulance work performed by the London and South Western staff. At the present moment the centre has 2,077 members, and no branch of its voluntary work is carried out with more zeal than that of first aid. Southampton Docks "C" team own the shield, silver medals, and £20, having made 223 points in a possible 300. The Wimbledon team were second, and Richmond third, Southampton Docks "B" team receiving a consolation prize. Cricketers, cyclists, and footballers obtained other awards, and in respect of shooting, a London and South Western squad carried off for the first time the shield offered by Mr. F. H. Dent for competition among the clubs affiliated in the London Railways Rifle League. Mr. A. H. Stanley added medals to the members of the winning team, who form a very smart body of marksmen. Other prizes have been added, and it is evident that the Rifle Club, which Mr. W. Buckmaster, the Secretary of the Brunswick House Institute has done so much to popularise, is holding its own. Swimming and billiards find other places in the programme of sport arranged every year, and the committee are to be commended upon the enthusiasm exhibited in every department.

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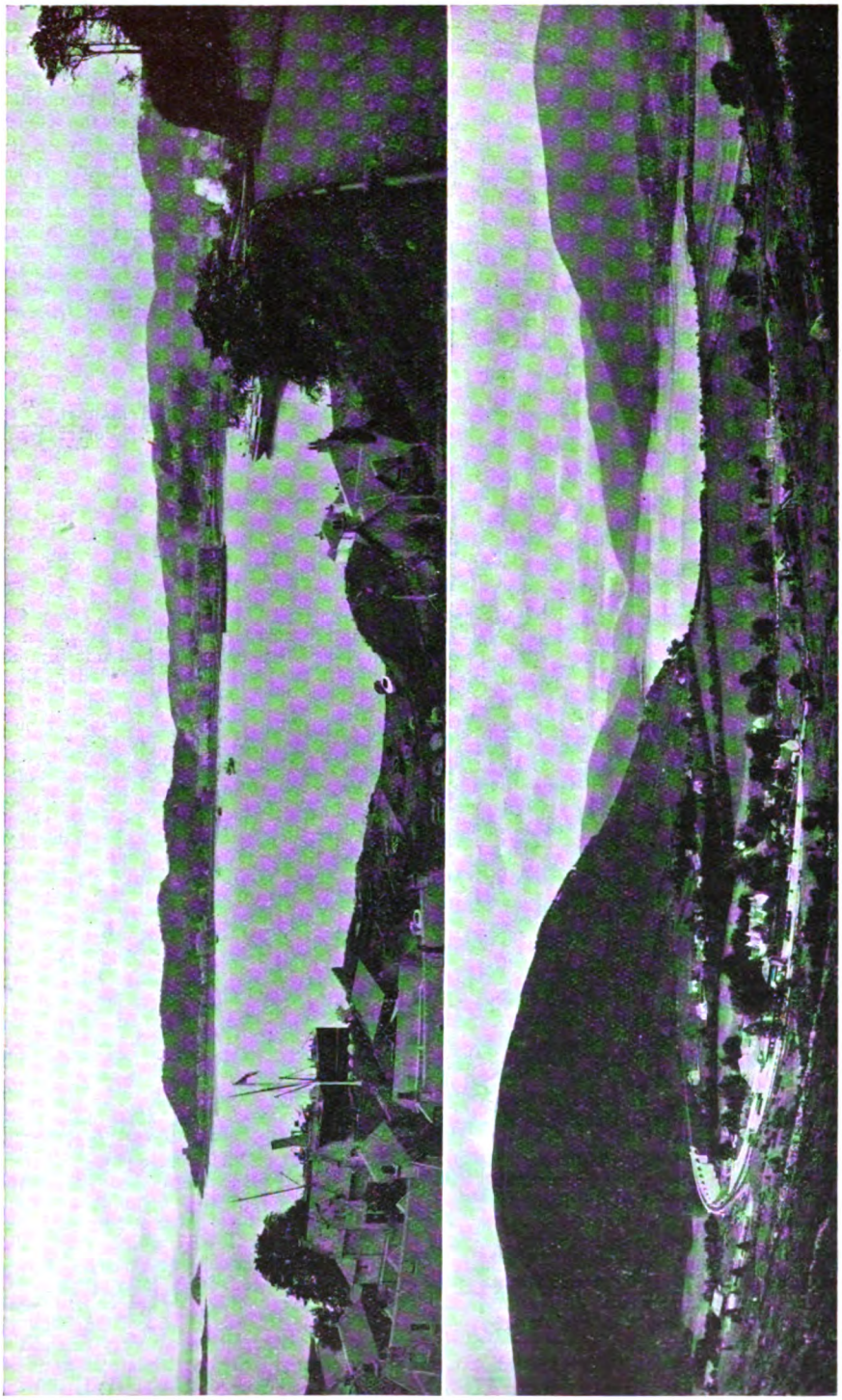

OBAN: FROM PULPIT HILL.
A VIEW OF LOCHEARNHEAD.
From Panoramic Photographs by Bull, Austin & Co., Ltd., 3, Crane Court, London, E.C.

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A COMPARATIVELY novel type of restaurant car has been added to the stock of the Great Northern Railway. The car is 52 ft. 6 in. long over body and 9 ft. wide. It has an entrance lobby 4 ft. 3 in. long, dining compartment 22 ft. 6 in. long, pantry 10 ft., kitchen 11 ft., 9 in. and attendant's toilet, 3 ft. 1 in. The body of the carriage is mounted on a steel underframe of the standard Great Northern type, and carried by two 4-wheeled bogies, the centres of which are 35 ft. apart. These bogies are of an improved type, which has recently been introduced as the standard for all Great Northern carriages. They have outside frames which allow increased width over the points of support, and so give steadier riding The bogies are fitted with 4 ft. 6 in. laminated bearing springs, having plates 4 ft. by ½ in., with indiarubber auxiliary springs under the eye-bolts. Two sets of swing links carry the double bolsters, upon which again another set of swing links is arranged to carry the second or internal bolster, giving two different sets of springs in series in the bolster arrangements. The vibrations, therefore, in travelling over the road, are transmitted through three separate sets of steel springs and the auxiliary rubber springs, before being transmitted to the frame of the coach itself. The body in turn is mounted on Spencer's patent body cushions upon the top of the steel underframe. The car has the Great Northern type of high elliptical roof, which gives a better air space than the old type of clerestory roof. It is lighted by electricity on Stone's system, having eight oxydized wall brackets with shot silk shades and six table lamps of the same material with similar shades. Three electric lamps are also fitted in the ceiling. Pullman vestibules and Buckey's couplers are provided, and the cooking is done by gas. Steam heating is on the non-storage system. The floor is built with double floor boards, the 1 in. space between the top and bottom boards being packed with hair felt. The lobby has teak framing with a dado of oak matchboarding, above which are sycamore panels. The ceiling is painted white, and the floor is covered with green and white indiarubber flooring. In the dining compartment the floor is covered with green pile carpet. All inside fittings are of oxydized silver. There are three large oval tables with four chairs to each, and three side tables with two chairs each, all in mahogany. The chairs are armchairs and are upholstered in tapestry to match the carpet. There are three large windows 4 ft. 6 in. wide on each side of car, and to provide ventilation small fanlights opening outwards are fitted to the top of the four end windows, the two centre ones being made to drop 9 in., and fitted at the top with a Stone's louvre ventilator. In addition to this, there are four torpedo ventilators in roof, and two electric fans fixed above the doors at each end. The window curtains are of grey silk rep. The two doors, blind boxes, pilasters, cornice mouldings, and window framings are in mahogany. To the top of the windows the panels are painted light grey, the upper part of the walls up to the cornice being covered with striped grey paper with a satin finish mounted on linen. The ceiling and end spandrels are done in the Tynecastle linen decoration, and painted white. The corridor has teak framing with oak matchboarding to the waist and sycamore panels above. All side lights are of obscured glass with the Great Northern Railway coat-of-arms in the centre of the large lights. The floor is covered with cocoanut muts. The pantry is fitted with the necessary wine cupboards, glass and crockery racks, hot water boiler, Berkefeld filter, two sinks, drainers, and knife cleaner, with wood grating on the floor. In the kitchen there is a Slater's gas cooking stove, hot closet and carving table, refrigerator, cupboards, sink, pastebords and chopping blocks, and a full system of ventilation is provided in the roof. Both the vacuum and Westinghouse brakes are supplied, and the usual arrangements of passenger communication in cases of emergency.

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TRAVELLERS by the Metropolitan Railway have no doubt observed the progress which has been made in connection with the duplication of the line from Wembley Park to Finchley Road—an important undertaking which will greatly influence the future prosperity of the railway. Large quantities of earth have already been removed for forming the bed of the new permanent way, and familiar embankments are gradually disappearing. At Finchley Road, where the additional lines will join the main route, the tunnels have had to be demolished for a considerable length, and the openings thus formed spanned by steel girders of heavy section which rest on concrete walls, with jack arches and concrete filling between the girders, so as to form a covered way similar to that carried out at the mouth of the tunnel under Park Road, near Baker Street station. The heaviest portion of the widening works will be the construction of the viaduct at Kilburn, but this presents no engineering difficulties. At Baker Street, improvements of a far-reaching and extensive order are being carried out, and

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are well advanced. This station, which is one of the busiest in London, is undergoing complete transformation, and the facilities to be afforded by the better accommodation which will be provided in the way of improved entrance to the station, larger booking hall, extensive circulating area, longer and wider platforms with broader staircases leading thereto, aditional lines will materially assist the Company in their efforts to develop and extend their long distance traffic. Two lines of rails connecting with the Inner Circle section have been laid through the station, and a greatly increased number of through trains to and from the City have recently been provided. This direct service is keenly appreciated by residents in the north-west suburbs and country districts served by the railway, as it greatly minimises, if not altogether removes, the inconvenience formerly experienced by the train change at Baker Street. The structural alterations and improvements at this station, revolutionary in their character, have been carried out with the minimum of inconvenience to the public, and it is only when one realises the extent of the work already done and the difficulties which have to be contended with that one can appreciate the extreme care and forethought necessary in preparing and arranging the details not only for the permanent works, but for the temporary accommodation which a radical change of this nature requires in order to avoid hindrance to the movements of the many thousands of people who daily use the station.

MR. JOHN MACAULAY:
General Manager, Alexandra Docks and Railway Company.

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ALTHOUGH associated with a relatively small railway company, Mr. John Macaulay, whose retirement on May 1st next from the position of General Manager of the Alexandra Docks and Railway Company is announced, is one of the best-known railway officers in the kingdom. His views upon shipping questions are usually considered as justifying special consideration while as a railway officer he holds a high place. The record of progress realised by the Alexandra Docks and Railways during the twelve years he has been in charge of its affair afford abundant evidence of his capabilities and while retiring from active management he will continue for a period of five years as expert financial adviser to the company. Mr. Macaulay was born in Edinburgh in 1853, and entered the service of the North British Railway in 1866. In 1874 he transferred his services to the Cheshire Lines Committee. While with the Cheshire Lines he had a varied experience. In recognition of his abilities, he was subsequently made superintendent at Brunswick Dock Station, Liverpool, where he remained for ten years. In 1894 Mr. Macaulay was appointed traffic manager of the Mersey Railway. Six years later he became General Manager of the Alexandra (Newport and South Wales) Docks and Railway. He is the author of many notable articles and pamphlets dealing with technical subjects connected with dock and railway administration, and is at present editing a new work, "Modern Railway Working," referred to on another page, to which he has contributed the section dealing with "The Economics of Dock Administration." Mr. Macaulay is a Justice of the Peace for the county of Monmouth, a member (and past-Chairman) of the Newport Harbour and Pilotage Commissioners, an Associate of the Institution of Civil Engineers, an ex-President of the Newport Chamber of Commerce, and an Honorary Associate of the Order of St. John of Jerusalem in England. He has been appointed to a seat on the Board of the Mold and Denbigh Railway. As representative of the Bank of England on the Llanelly Harbour Trust, Mr. Macaulay did much good work until the liability to the Bank of England was taken over by the town. His advice and aid have also been sought on behalf of various railways in this country and abroad. He was largely concerned in the reconstruction of the Dunderland Iron Ore Company.

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As the headquarters of the locomotive and engineering departments of the London and North

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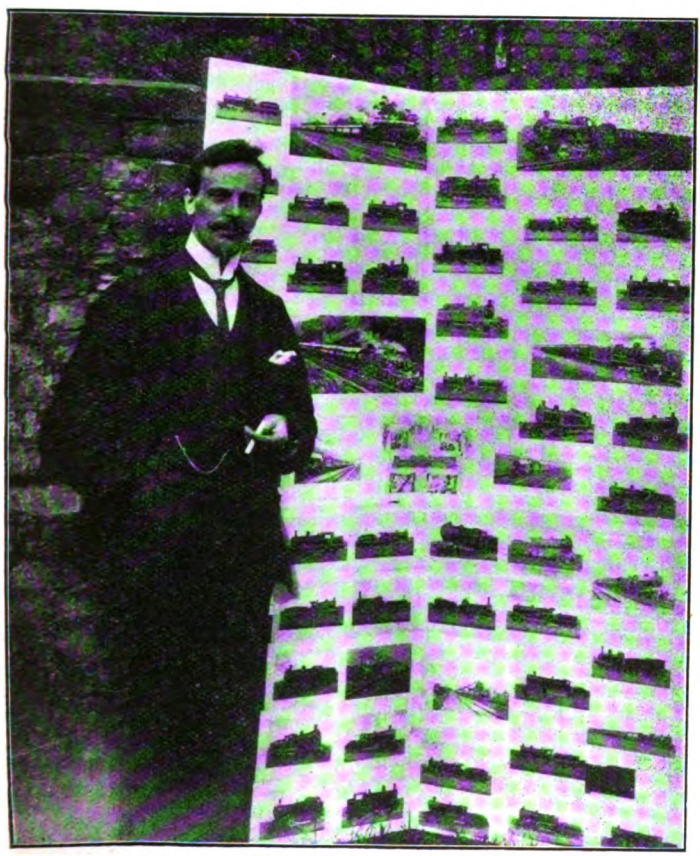
Western Railway, Crewe is, of course, well known; but apart from this fact it offers many inducements for the establishment of new industries, or the erection of extensive works and factories. A glance at a map will show how conveniently Crewe is situate with regard to the manufacturing districts of the centre and north of England, while the coalfields of North Staffordshire are only a few miles away. Indeed, its advantages in this respect have already been realised to some extent, a number of industrial works being now located there; while the town possesses considerable commercial importance apart from its railway activities. As a railway centre, Crewe is unique, forming the hub of the whole of the far-reaching North Western system, while, in addition, close connections are there made with the Great Western and North Staffordshire Railways, linking up the great manufacturing centres of the North with the Midlands and the West and South of England. Geographically, it will be seen that within a radius of 50 miles Crewe is in close touch with many of the chief manufacturing districts of the country, and it must not be forgotten that it is the converging centre through which passes the greatest part of the traffic to and from Ireland. It has been said that a traveller can reach, within 12 hours from Crewe, the most outlying parts of the United Kingdom, but what is more important is the fact that a business man with his headquarters at Crewe, may reach any of the chief manufacturing towns of the North and the Midlands within an hour or an hour-and-a-half to two hours' journey, while three hours is the average time of a run to the Metropolis. The railway arrangements at Crewe for this purpose are peculiarly complete and comprehensive. Within the Borough of Crewe, and in the near proximity there are many useful sites suitable for immediate development of works or manufactures of all kinds, any of which can be obtained at a very reasonable price, and landlords are co-operating with the Corporation in fixing prices so as to encourage the development of the district. A booklet has been issued by the Corporation of Crewe giving full particulars (with map) of area at present available, as well as information concerning railway rates, arrangements for private sidings, local electricity, gas and water supplies, labour conditions, health and institutions, and other matters which have to be taken into account by manufacturers and business men. Copies will be supplied by the Town Clerk on application to the Municipal Offices, Earle Street, Crewe.



A RAILWAY SCREEN CONSTRUCTED BY A "RAILWAY MAGAZINE" READER.

* * *

A MANCHESTER reader, Mr. Martin Walster, sends a photograph, reproduced on this page, depicting a railway screen constructed by himself. It consists of a frame comprising four long timbers 6 ft. by 1¼ in. by ¾ in. and six pieces 2 ft. 3 in. by 6 in. by ½ in., nailed together and covered with tightly stretched canvas, the two sections being hinged together. The coloured plates, all issued from the offices of the RAILWAY MAGAZINE and most of them presented with the monthly numbers, were then attached by means of a stiff starch paste. As completed the screen is not only a very satisfactory production, but also receives special attention from all who see it; and Mr. Walster, who is seen in the photograph in charge of his handywork, is to be congratulated upon the result of his labours. In sending the photograph, he reminds us that he has been a regular reader of the RAILWAY MAGAZINE for many years, and though not a railwayman, is often able to assist his railway friends by imparting to them information originally given in our pages.

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The exceptional share of sunshine which the many pleasant resorts of the South Coast and Isle of Wight enjoy, coupled with the protection from the north winds afforded by the magnificent Downs at the rear, causes the South Coast to be selected at Christmas by a large section of the public. Each year the splendid hotels in the southern towns vie with each other in producing the most attractive programme for their visitors, who are rapidly increasing in numbers. Its close proximity to London also makes the South Coast particularly convenient for the heads of large business houses who find it necessary to make flying visits to town to attend to matters of urgency. It is not surprising, therefore, that the special holiday arrangements made by the London, Brighton and South Coast Railway, covering numerous cheap day and period bookings, as well as many convenient facilities, at ordinary or holiday fares, are liberally utilised by all classes of passengers. The Christmas arrangements cover supplementary trains on Tuesday, December 24, with special late services to all parts of the system. Indeed, as regards Brighton itself, fast trains leave London about every hour between 9 a.m. and 8.30 p.m., while other places are served on a corresponding basis, suited to their requirements. Special cheap tickets, issued from Victoria, London Bridge, Kensington, and certain main line suburban stations, to most seaside and health resorts by certain trains on Tuesday, December 24, available to return on Wednesday and Thursday, December 25 and 26, cover the holiday period in a way which suits nearly all requirements. The usual cheap day return tickets to Brighton, Worthing, Seaford, Eastbourne, Bexhill, St. Leonards, Hastings, Littlehampton and Bognor, with a 3s. excursion to Brighton, Hove and Worthing on Christmas Day and Boxing Day, supply the needs of another section of the public. On Christmas Day the ordinary Sunday service is arranged, including the "Southern Belle," from Victoria to Brighton in 60 min., with the exception of the 10.45 a.m. Pullman express Victoria to Eastbourne. For the convenience of visitors returning to London on Thursday, December 26, special fast trains leave Worthing 4.12, 5.24, 6.40 p.m., Hove 4.40, 5.49 and 6.55 p.m., Brighton 5, 6.5 and 7.30 p.m., Hastings 5.10 p.m., Bexhill 5.26 p.m., Eastbourne 5.30 and 9.30 p.m., Seaford 5.38 p.m., Portsmouth Harbour 4.45 and 7.10 p.m. The usual day excursions to places nearer London also apply over the holidays, and extra trains will be run from London to the Crystal Palace, for the special holiday entertainments, including Grand Pantomime on Boxing Day and following days, as required by the traffic, returning in the evening at frequent intervals. A special 15-day excursion to Dieppe, Rouen and Paris is arranged *via* the Newhaven-Dieppe Royal Mail route, on Friday, Saturday, Sunday, Monday and Tuesday, December 20 to 24, by the express day and night services from Victoria and London Bridge. A feature this year is an excursion to the Riviera (Cannes, Nice, Mentone, etc.) on Monday, December 23, from Victoria, at 10 a.m. Through tickets are issued and baggage registered through *via* Newhaven and Dieppe to all the principal health and pleasure resorts of Switzerland, and to Innsbruck, Meran and Vienna.

During the past summer Messrs. Bull, Austin & Co., Ltd., on behalf of the Caledonian Railway, have undertaken a series of panoramic photographs depicting many of the beauty spots of Scotland. The camera used for these enables views to be taken extending from, and even exceeding, 180 degrees, covering a range quite unobtainable by ordinary methods. A number of highly successful pictures have been obtained, covering seaside and holiday resorts, embracing in some cases the full extent of a promenade, while other subjects have been photographed in a manner which could formerly be obtained only by piecing together separate sectional views with more or less indifferent results. Two of these photographs are reproduced on page 82. One is a general view of Oban, taken from Pulpit Hill, and showing the whole of the bay. The other is a view of Lochearnhead, including the Loch, and the mountains in the distance, with the railway and Lochearnhead viaduct in the foreground. The notable results obtained by this method of photography are admirably set forth by these examples, especially if compared with the views of the same places reproduced in the Railway Magazine, September and October, 1912. The diversified scenery met with in Scotland lends itself admirably to subjects of this character, and we look forward to seeing many others of these panoramic photographs in the various publications issued by the West Coast Railways. The Caledonian system, while not monopolising the scenic attractions of the northern kingdom, provides convenient and comfortable access to nearly all the districts of special interest, while, as the southern partner in the West Coast combination, the London and North Western Railway is largely responsible for the splendid train services and facilities whereby England and Scotland are linked together. By West Coast service one can travel expeditiously, comfortably and cheaply from almost any part of England to the numerous scenic districts of Scotland, including not only the Caledonian Railway itself, thus covering a wide range of choice, but also the Highland and Great North of Scotland lines, both of which constitute, in effect, extensions of the West Coast system of railways.

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On page 526 of our last issue a photograph was reproduced of a new 4-6-2 engine recently added to the stock of the Grand Trunk Railway of Canada. Eight of these engines, known as Class P4, have so far been placed in service. They are fitted with superheating apparatus, piston valves, and Walschaert valve gear, but in other ways correspond with the usual practice of the railway. The cylinders are 23 in. diameter, with a stroke of 28 in. Coupled bogie and trailing wheels are respectively 6 ft. 1 in., 2 ft. 7 in. and 4 ft. 1 in. diameter. The boiler is 5 ft. 10 in. diameter, its centre line being 9 ft. 5¼ in. above rail level. Steam pressure is 185 lb. per sq. in. The total heating surface is 3,417 sq. ft., and the grate area 50·62 sq. ft. A weight of 63 tons is placed on the coupled wheels, the total weight of engine in working order being 104½ tons. The tender carries 10 tons of coal and 8,000 gallons of water, its weight loaded being 67 tons.

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The wheelbase of engine is 33 ft. 2 in., and with the tender 62 ft. 3½ in. Total length over buffers is 72 ft. ¼ in.

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MR. JOHN MONTAGU EDDY, who succeeds the late Mr. Mitchelhill as Mineral Traffic Manager of the London and North Western Railway, is the son of the late Mr. E. M. G. Eddy, who was for many years an officer of the London and North Western Company, and who subsequently was the first Chief Commissioner of the New South Wales Government Railways. Mr. Eddy entered the service of the North Western Company in 1898, and was attached to the Goods Department, where he gained experience in the South Staffordshire, Northampton and London districts. In 1900 he was transferred to headquarters, where he was attached to the Outdoor Goods Manager's Department until 1903, when he was appointed Assistant to the Traffic Superintendent for the Lancaster division. After two years at Lancaster Mr. Eddy was created Assistant Rolling Stock Superintendent, and, when Mr. Rowell resigned early in 1911, Mr. Eddy succeeded him as Rolling Stock Superintendent, a position he held up to the time of his appointment as Mineral Traffic Manager.

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"THE 6.30 Down" is the title of a booklet just issued by Messrs. Bassett-Lowke, Ltd. It is, of course, designed to attract attention to the model railway material supplied by this firm. The particular locomotive models to which notice is drawn are those of a London and North Western "Experiment" and a Midland Deeley compound, the fact that main line engines of the latter class may be seen hauling the 6.30 p.m. down express from St. Pancras providing the text of the booklet. Included are a series of model railway illustrations which will, no doubt, arouse the envy of youthful readers into whose hands it may come—with results which, as far as *pater familias* is concerned, do not require to be directly specified within a few days of Christmas. Messrs. Bassett-Lowke supply a steam scale model of Midland compound No. 1000, with two scale model Midland bogie carriages and a bogie brake van (total length of train, 5 ft. 10 in.), and with a set of tinplate rails for £2 18s. 6d. in 1¼ in. gauge, or £6 6s. in 1¾ in. These sets are also provided with a clockwork locomotive. Corresponding sets providing London and North Western or Great Western trains are also supplied in 1¾ in. gauge at £6 6s. Reference may also be made to Messrs. Bassett-Lowke's illustrated catalogue, including views and particulars of engines, rolling stock, rails, and other requisites for model railway construction and operation, to suit all purses and requirements. Copies are supplied at 3d. each.

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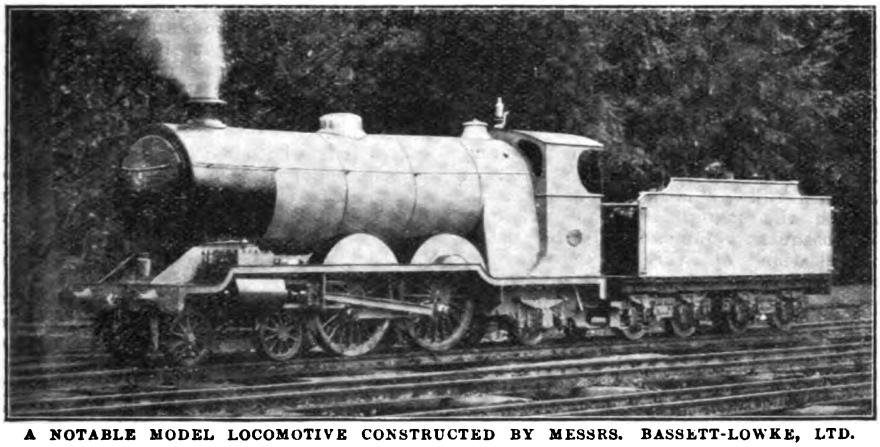
BRISTOL was visited recently by Mr. Frank Potter, General Manager of the Great Western Railway, and we learn on good authority that a scheme is nearly ripe for extending the accommodation for passenger trains at Temple Meads station. The plan is to carry a line from a point near Kingsland Road across the Floating Harbour on the south side of the present bridge, along the carriage road bordering the cattle market, to join the line running into the bay over the tidal river whence some of the local trains start. By this means an extra platform for down trains will be provided, and the booking offices and roadway will be placed underneath the new platform and line, to which access will be gained by lifts. The cost of the extensions will probably be £250,000. Attention is also being devoted to providing further much-needed accommodation for local trains. No scheme has been formulated, but the idea prevails that a station to and from the west shall be placed at the goods station on the Knowle side of Bath Bridge over the tidal river. It is further stated that these alterations and extensions are but the initial steps in a scheme which will absorb a total outlay of approximately a million. The traffic requirements of Bristol are increasing considerably, and the need for further accommodation is imperative.



A NOTABLE MODEL LOCOMOTIVE CONSTRUCTED BY MESSRS. BASSETT-LOWKE, LTD.

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A SET of six geographical postcards has been issued by the Metropolitan Railway Company. Each card constitutes a map of a section of the route from London to Chesham, Aylesbury, Brill, and Verney Junction, showing the railway,

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roads, golf links, and places of interest along or near the line. Excursionists and others are thereby provided with series of local postcard guides. Mention may be made of the fact that the Extension line of the Metropolitan Railway serves one of the most beautiful parts of England. Numerous cheap tickets are issued, many of them covering pedestrian or cycle tours, while through trains from Liverpool Street and City stations enable a change at Baker Street to be avoided during the greater part of the day. The complete set of six card can be obtained for one penny at any of the station bookstalls, or two pnece post free from the Publicity Department of the Metropolitan Railway, Edgware Road station.

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A practical treatise, entitled "Modern Railway Worhing," and written by engineering and administrative experts under the editorship of John Macaulay, General Manager, Alexandra (Newport and South Wales) Docks and Railway, assisted by Cyril Hall, is being published by the Gresham Publishing Co. This work is to be issued in eight volumes, super-royal octavo, bound in cloth, at 7s. 6d. net, per volume, sold in complete sets only. It aims at providing an encyclopædia of railway work, covering all phases, legal, administrative and technical. The first volume deals mainly with the history, constitution and management of railways. Mr. Cyril Hall deals with early history; Mr. F. McDermott with the constitution of railway companies and their financial and legal status; Mr. F. C. Mileham with railway law; and Mr. S. M. Phillp with the manipulation of passenger traffic. Subsequent volumes will be devoted to the organisation of various departments, design, construction and maintenance of railway works, railway mechanical and electrical engineering, railway economics, foreign and colonial railways, and other subjects.

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At the usual monthly meeting of the Railway Club, held on December 10th, at 92, Victoria Street, Westminster, Mr. Vernon Sommerfeld, read a paper entitled "The Express Train of the Future." He considered, first, the probabilities of the period 1920-30, based upon the possible developments of the present, and secondly the conditions likely to be obtained in 1960. Necessarily electric traction figured prominently in these anticipations, but Mr. Sommerfeld does not look forward to very wonderful increases in actual speeds, though there may be a raising of maximum average rates. Other remarks covered the suggestion that supplementary fares for principal trains will become usual, the extension of multiple-unit systems of train make-up, and the like. Many other points were brought out by the animated discussion which followed. The Annual Dinner, held at the Holborn Restaurant on Friday, December 13th, was a highly successful function. Mr. W. Parker occupied the chair, and there was a good attendance of members with a few friends. Mr. Bazley and other gentlemen assisted as regards the musical and similar arrangements as in former years, presenting an attractive and enjoyable programme. The Annual General Meeting will be held on Tuesday, January 14th, and will be followed by a short paper. Prospective members are reminded that the commencement of the financial year offers a good opportunity for associating themselves with the Railway Club.

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The United Kingdom Railway Officers' and Servants' Association was established in 1861 to afford assistance in time of distress and necessity to railway officers and servants, their widows and orphans. During an existence of half a century it has expended over £55,000 in annuities, £100,000 in rendering assistance in times of sickness, £60,000 in payments to widows and members at death, and about £15,000 for the benefit of orphans and in special grants, making a total of £230,000—truly a record of which its supporters may be proud. The association is strictly non-political and unsectarian, it takes no part in labour questions, neither is it connected with any other society. Its affairs are conducted by a Board of Management consisting of officers from various railways, who give their time and services gratuitously. We are convinced that the association, with such a highly creditable record, will receive, as it richly deserves, the generous support of readers of the Railway Magazine in every part of the world. The Secretary, Mr. Alfred James, will be pleased to supply further information, and to receive donations at the offices, of the Association, 21, Finsbury Pavement, London, E.C.

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Messrs. Bassett-Lowke, Ltd., have just completed, what is, we believe, the largest 15 in. gauge scale model locomotive yet built (illustrated on page 87). This design was prepared in 1911 for Mr. R. P. Mitchell but the first locomotive to be completed is one just built for Sir Robert Walker, Bart., of Sand Hutton, Yorks. The leading particulars of the locomotive are as follows:—"Atlantic" type; cylinders, 4 in. by 6¾ in.; length over engine and tender, 15 ft. 9 in.; height to top of funnel, 3 ft. 4 in.; driving wheels, 19 in. diameter; working pressure, 120 lbs. per sq. in.; the approximate weight of engine and tender in working order, 2 tons 12 cwts. The photograph reproduced was taken at the trials of the engine at Sir Robert Walker's. Only about 350 yards of track is completed, and sufficient rolling stock is not yet available for proper speed and hauling tests, but the makers have no doubt that the engine will more than exceed the designer's expectations. Like the improved "Little Giant" class, she is fitted with superheater and forced lubrication.

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The Great Eastern Railway, Christmas programme of holiday and excursion arrangements, well maintains the artistic standard realised in previous issues. The cover has again been designed by Miss Prytherch, and is exceedingly neat without undue elaboration. Enclosed are the usual comprehensive particulars of holidays arrangement, covering ordinary trains as well as numerous excursion and special facilities.

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Mr. James Calder, at present Chief Assistant to the General Manager of the North British Railway, has been appointed by the directors to the new position of Assistant General Manager.

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(From a photograph by F. E. Mackay.)

OSTEND BOAT EXPRESS: SOUTH EASTERN AND CHATHAM RAILWAY.

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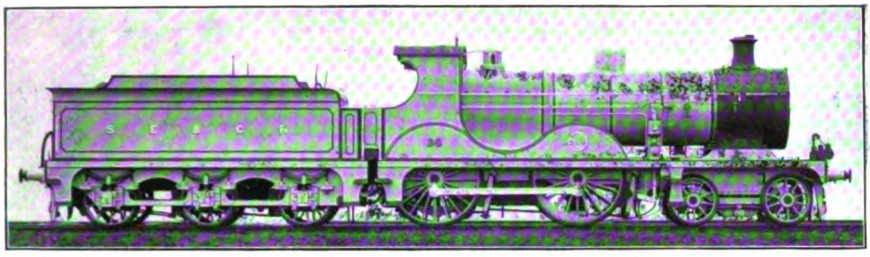

ONE OF THE LATER EXPRESS LOCOMOTIVES WITH BELPAIRE FIREBOX AND EXTENDED SMOKEBOX, NOW FITTED WITH ROBINSON SUPERHEATER.

Modern Locomotive Practice on the South Eastern and Chatham Railway.

By J. F. GAIRNS.

THE South Eastern and Chatham Railway provides one of the most conspicuous instances of the operation of heavy and difficult traffic by means of locomotives of moderate dimensions, embodying few of the special characteristics usually associated with modern practice at home or abroad. Yet no one who is qualified to appraise the quality of the work regularly performed by Mr. Harry S. Wainwright's engines can avoid the conclusion that, while requirements would justify the introduction of larger and more notable engines, the traffic is operated in a manner which reflects great credit upon the locomotives employed under present conditions. It is true that average speeds of 50 miles an hour between stops are virtually non-existent; and at first sight the schedules even of the best trains do not indicate work of a remarkable character. Indeed, there is a tendency in many quarters to estimate the performances of South Eastern and Chatham locomotives upon a relatively low standard; but this disposition is shown by observers whose ideas of great achievements are based mainly upon high average and actual speeds.

Traffic requirements are, however, much more difficult than is usually realised, and there are few railways where, when all factors are considered, the work is more meritorious. Before dealing with the principal locomotive classes in use, it will be advisable to review the principal difficulties, hindrances and other considerations which govern train working on this line. As an amalgamation of two railways at one time competitive to many places, the South Eastern and Chatham system offers a variety of train routes, further complicated by the connecting loops which have since been constructed. Five more or less distinct routes are in regular use for important main line trains between London and Dover, and three or four are included in the schedules of expresses to the Kent coast branch from Faversham. In addition, stopping or semi-fast trains introduce other route variations, and, as the work of most of the main line engines includes working trains of many different classes, it follows that every locomotive must to all intents and purposes be able to go anywhere. Consequently the engineering restrictions of the system govern the weight and dimensional limitations of all engines.

It is generally considered that the South Eastern main line is easier than that *viâ* Chatham, but the difference is mainly one of degree. The South Eastern line in a large measure concentrates its principal difficulties over the Charing Cross-Tonbridge section, while at Chatham many of the drawbacks from Victoria end, with, however, a larger proportion remaining beyond that town. From Charing Cross to London Bridge, owing to curves and traffic complications, high speed is impossible. Just after passing St. Johns's a 4½ mile grade begins to Elmstead, mainly at 1 in 140 or 1 in 120, with the Chislehurst tunnels on the severest portion. Half a mile of level is followed by virtually 6 miles at grades ranging from 1 in 234 to 1 in 120, harder inclines predominating. A sharp fall provides 2 miles of 1 in

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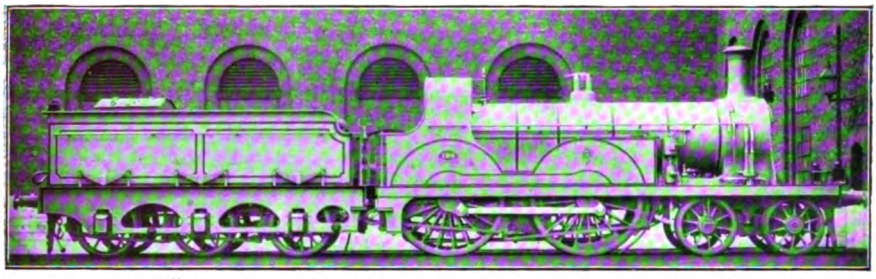
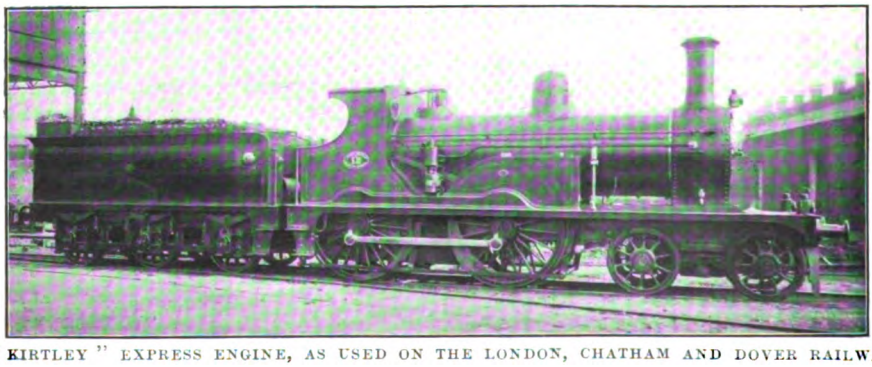


A "STIRLING" EXPRESS LOCOMOTIVE, AS USED ON THE SOUTH EASTERN RAILWAY.

143 for up trains, this grade being mainly in tunnel—a circumstance which is not conducive to good climbing. Down trains then have nearly 2 miles of 1 in 160, followed by 6 miles of descent at 1 in 144 and 1 in 122. This is a very difficult stage indeed for up trains, especially as it concludes with 2 miles through Sevenoaks tunnel, probably the most slippery on the system. Summarising, one may say that the Charing Cross-Tonbridge section of 29½ miles includes 11½ miles of hard climbing for down trains, and 9½ miles, possibly more difficult, for up trains, nearly 5 miles being in tunnel, with the hindrances of London traffic at one end and the Tonbridge slack at the other. From Tonbridge to Ashford is relatively easy, though it is more difficult than is usually thought. Over this section, however, averages of 55 miles an hour, or even higher, are usual, the 26½ miles being often covered in 29, 28, 27 or even 26 min. Beyond Ashford, the line rises at moderate grades to beyond Westerhanger, and then continues as a long descent of 11½ miles to Dover Town. For up trains this continuous grade, though never exceeding 1 in 238 and mainly at 1 in 266, is somewhat trying, owing to its virtually unbroken character and the inclusion of several tunnels, especially those near Dover.

The Chatham route does not permit of high speed until Herne Hill is cleared, and then it rises at about 1 in 100 to the Penge tunnel. Thenceforward to Sole Street there is a constant succession of up and down grades, largely at about 1 in 100, but including a mile at 1 in 95, though its undulating character tends to assist engine working. It is usually considered, however, that an average of 40 miles an hour from Victoria to Sole Street is good work. The descent of 1 in 100 for 5 miles to Rochester Bridge is not of great advantage for down trains, owing to the necessity for holding in for the sharp curves at the base; but for up trains this ascent is the worst involved on the line. From Rochester Bridge to Gillingham slow speed is entailed owing to curves, traffic complications, the existence of a series of tunnels, and a concluding grade of 1 in 132. To Faversham the road is easier, and good running is made. Indeed, as regards the Kent Coast services averages are usually considerably over 50 miles an hour from New Brompton to Margate West, including a slack at Faversham and the existence of several grades which cannot be ignored. The continuation from Margate West to Ramsgate is, however, very difficult, especially the up start from Ramsgate Harbour through tunnels on a grade of 1 in 75 for over a mile and a half. From Faversham the main line



A "KIRTLEY" EXPRESS ENGINE, AS USED ON THE LONDON, CHATHAM AND DOVER RAILWAY.

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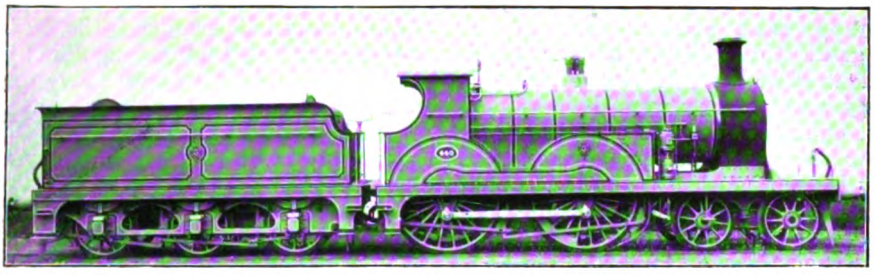
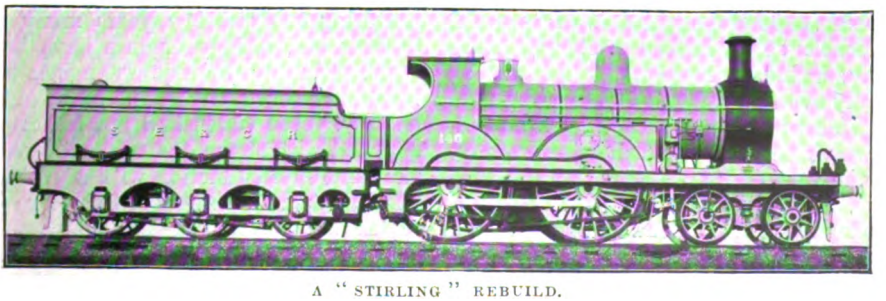


MR. STIRLING'S LARGEST MAIN LINE CLASS BEFORE THE AMALGAMATION OF THE TWO SYSTEMS.

includes, for down trains, the Selling bank of about 1 in 100 for 4 miles, while in the 9 miles from Canterbury to the summit before Shepherds Well are 7 miles largely at 1 in 132 and sometimes even steeper. Up trains from Dover have a continuous climb at 1 in 106 or 1 in 132 for 7 miles, and 5 miles at 1 in 132 from Canterbury. As regards the Hastings branch, in addition to the hard stage from London to Tonbridge, the remaining distance is a succession of severe inclines, which afford abundant justification for the mediocre averages of the expresses. The route followed by several expresses from Swanley to Maidstone and thence to Ashford, is also difficult, including frequent grades of about 1 in 100, though easier beyond Maidstone.

This review of gradients and traffic hindrances is required in order to indicate the character of the work regularly done by Mr. Wainwright's locomotives. It is also necessary to remember that few of the Continental expresses have less than 300 tons behind the tender, while the inclusion of two or three Pullman cars on all the principal services frequently entails loads of from 330-360 tons. The Kent Coast expresses regularly load to 280 tons in the summer, and sometimes the fastest schedules have to be made with 300 tons. There are, of course, many lighter trains than these, but a general average may be taken as 250 tons, while heavy loads are frequently associated with the fastest bookings. In addition, small coal is usually employed on the South Eastern and Chatham Railway, and while low consumption can hardly be expected on the harder runs, the fuel often supplied is not conducive to specially good work, though on the whole the results given in this respect are very satisfactory.

Before the amalgamation of the South Eastern and Chatham systems Mr. Stirling's engines of the 440 class were the principal ones for express traffic on the South Eastern section, while Mr. Kirtley's later bogie engines dealt with the requirements on the Chatham. The latter were not particularly notable, even having regard to the date of construction of the earlier series. They may, indeed, be said to correspond with Mr. Stirling's 240 class, whereas the 440 design is more up-to-date. All these engines still work a considerable proportion of the general traffic, and many have since been rebuilt by Mr. Wainwright, to bring them more or less up to present standards. It is only rarely, however, that these pre-amalgamation engines now haul principal trains, except perhaps on the Hastings branch, but they still have a fair amount of good work to do, and much of the more ordinary traffic falls to their lot. All the Stirling engines had domeless boilers, as was usual in that gentleman's practice, and the 440 class were the first express engines with square-roofed cabs, the rounded type being otherwise standard. The use of 7-ft. coupled wheels and large



A "STIRLING" REBUILD.

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cylinders, with relatively small boilers, has always appeared somewhat strange in view of the gradient difficulties; but the engines have done good work in view of the conditions for which they were designed. As rebuilt, domes and square cabs have been fitted to the South Eastern engines. The Kirtley locomotives had 6 ft. 6 in. coupled wheels. Views of Mr. Stirling's 240 and 440 classes, of a 240 class rebuilt, and of a Kirtley engine are given, and from these the principal features will be apparent. The appended table indicates the principal dimensions.

	240 Class.	440 Class.	Kirtley Class.	240 Class rebuilt.	Kirtley Class rebuilt.
Cylinders (inches)	19 × 26	19 × 26	18 × 26	18 × 26	18 × 26
Coupled wheels	7 ft. 0 in.	7 ft. 0 in.	6 ft. 6 in.	7 ft. 0 in.	6 ft. 6 in.
Steam pressure (lbs. per sq. in.)	160	160	150	170	170
Heating surface, Tubes (sq. ft.)	881·5	976·0	1010	1011·2	1000·9
Firebox (sq. ft.)	103·5	111·5	110	112·8	111·2
Total (sq. ft.)	985	1087·5	1120	1124	1121
Grate area (sq. ft.)	16·5	16·5	17·3	16·5	17·3
Weight in working order (tons)	42½	46	42¾	45	42¾

In 1899 Mr. Wainwright was appointed Locomotive Carriage and Wagon Superintendent of the South Eastern and Chatham Railway, and made responsible for the rolling stock of both companies, though for some time there was little inter-working between them. A six-coupled goods engine was the first designed by him, No. 255 appearing in 1900. This type constitute a useful class, being a considerable advance upon the goods engines used by either company before the amalgamation. The design was, however, a straightforward one without special features, except as regards certain appliances which have since become standard. The steam reversing gear consists of steam and cataract cylinders, placed vertically on the foot-frame, adjacent to the weigh-bar shaft of the valve motion. An improved design of cab, doors between engine and tender, steam sanding devices and spark arrester were also included in the equipment. These engines have taken a considerable share in the passenger train working, including occasionally fast trains, especially over the difficult Hastings branch.

Mr. Wainwright then turned his attention to the tank engines, producing in January, 1900, the first of the 0–4–4 side tank condensers, 710 class. These may be described as developments of the London, Chatham and Dover tank engines previously in service, but with larger dimensions and certain changes to accord with the newer practice. Immediately following came the first of the well-known 4–4–0 express engines of the 731 class. In addition to steam reversing gear and other standard features, Mr. Wainwright's spark arrester was fitted. Dimensions were larger than those of any engines previously in service, and special attention was paid to appearance, the neat outline of splashers, brass beading thereto, brass dome cover and copper rim to the chimney giving the engine a distinction which always appealed to the public. These locomotives have done good work, and are still always engaged in the principal services, notwithstanding the subsequent introduction of improved designs developed therefrom.

In 1903 further engines were constructed, including a few variations. In 1906 Mr. Wainwright introduced Belpaire fireboxes, beginning with No. 273. In subsequent series extended smoke-boxes were added, and No. 516—the Royal engine—may be said to represent the latest development of this practice. The first of a new class of 0–4–4 engines was built in 1904 for working the heavier suburban trains, particularly, though not exclusively, on the South Eastern section. These represented a marked advance upon all earlier classes. Soon after, Mr. Wainwright constructed several rail motor cars for light traffic of the type in which a small locomotive is combined with and carries one end of a carriage. Mention may also be made of the small 0–6–0 tank engines used for light branch traffic.

During the last few years many of the Stirling and Kirtley engines have been rebuilt, including the express engines already mentioned and many of the goods and tank engines, those which had not hitherto been supplied with steam domes usually receiving the same in conjunction with a Wainwright boiler. At the beginning of last year No. 275 of the first Belpaire 4–4–0 class was fitted with a Schmidt superheater, Wakefield lubricator, and piston valves, the steam

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PRINCIPAL DIMENSIONS OF LOCOMOTIVES CONSTRUCTED DURING MR. WAINWRIGHT'S RÉGIME.

Class	676	255	710	731	516	531	Rail motor car	0–6–0T	4–4–0 (Schmidt superheater).
Type	4–4–0	0–6–0	0–4–4T	4–4–0	4–4–0	0–4–4T	10 × 15	12 × 18	275
Cylinders (inches)	18 × 26	18½ × 26	17½ × 24	19½ × 26	19½ × 26	18½ × 26	3 ft. 7 in.	3 ft. 9½ in.	20½ × 26
Coupled wheels	6 ft. 1 in.	5 ft. 2 in.	5 ft. 6 in.	6 ft. 8 in.	6 ft. 6 in.	5 ft. 6 in.	160	160	6 ft. 6 in.
Steam pressure (lbs. per sq. in.)..	165	160	160	175	180	160	337	387·34	160
Heating surface, Tubes (sq. ft.) ..	1093·5	1089·32	971·7	1381	1396	1002·45	44·5	51·69	Smoke tubes .. 1062·80
Firebox (sq. ft.)	113·5	110·68	100·6	124	136	102·20	381·5	439·03	Superheating tubes 266·0
Total (sq. ft.) ..	1027	1200	1072·3	1505	1532	1104·65			Firebox 136·0
									Total 1464·86
Grate area	18	17	16·25	20·3	21·15	16·6	8·8	9·1	21·15
							Engine 27½		
Weight of engine in working order (tons)..	44½	43¾	51½	50	52¼	54½	Engine and Carriage 41¼	28½	52¼

pressure being reduced to 160 lbs. per sq. in. This engine has done splendid work, and was specially employed on the hardest Continental trains during the late coal strike. No. 746, of the original 4–4–0 class, has also been fitted with a Weir feed water heater and Weir pump. Engine No. 36, one of the later Belpaires, has been fitted with the Robinson superheater.

Reference may now be made to the steam reversing gear and spark arrester used by Mr. Wainwright. The spark arrester consists of a double cone, consisting of a frame of ten bars, fitted to the base of the chimney. These bars are 1¼ in. wide and ¼ in. thick, and on their edges notches are formed in which a continuous ¼ in. steel wire is wound. A brass ring on which slots are cut, is placed over the blast pipe, so that the suction action of the blast is carried well down in the smokebox. The reversing gear, which is a modification of that introduced by Mr. Stirling, consists of a steam cylinder over a water cataract cylinder, steam to the former being controlled by a small slide valve worked from the footplate, a second lever governing the admission of steam and water. In the lower cylinder water is on both sides of the piston, and unless a passage way be available, the piston is thereby held firm in any position. To operate the gear a valve is opened, so that water can pass from one side of the piston to the other. Steam is then admitted to one end or the other of the steam cylinder, so that the piston moves to operate the gear, carrying with it the water piston fixed to the same rod. The extent of motion is shown on an indicator, and the driver can stop at any stage of the movement by closing the water cock, holding both pistons firmly in the position reached.

It is necessary to pay some attention to the work done by Mr. Wainwright's express engine. Here special reference must be made to the Continental services, in view of the fact that all the year round the schedules are hard and loads are in most cases heavy. The seaside services are usually somewhat easier, but in the summer big loads are frequently entailed, and when these are coupled with fast schedules, such as those of 90 min. for the 74 miles from Victoria to Margate West, very hard work is involved. Except for one run on Sundays from Deal to Victoria, the longest non-stop runs are those of the Continental expresses to and from Dover—76½ miles from Charing Cross and 78 miles from Victoria. Others are from Victoria to Margate West (74 miles), Charing Cross to Folkestone Junction with Continental trains (71 miles) and seaside trains from Victoria or Charing Cross to Folkestone Central, Sandling Junction, Westgate, Canterbury, and other stations. As a rule there are about 50 trains daily with non-stop runs of 50 miles or more. Duplication of trains is also very common on the South Eastern and Chatham Railway. Certain Continental services almost invariably require two trains, and others are duplicated at least once or twice a week, while three trains are occasionally necessary to carry the traffic.

A selection of records of work done may here be

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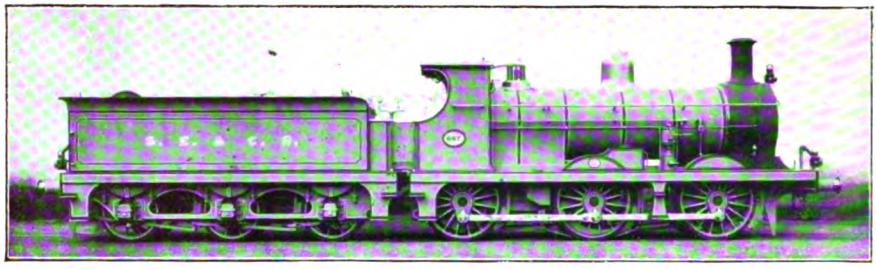


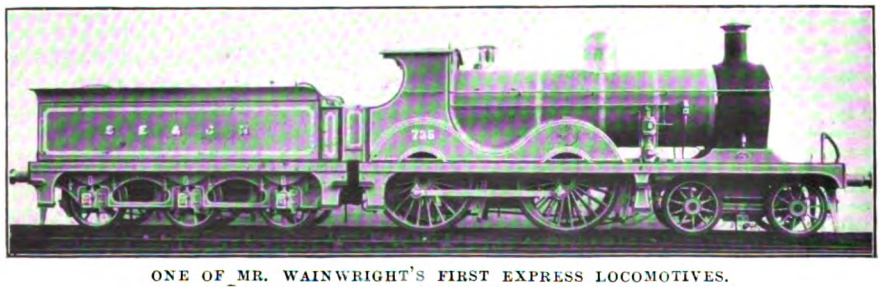
STANDARD GOODS ENGINE.

made. Two runs with one section of the 9 a.m. Continental express from Charing Cross may first be mentioned. No. 275, fitted with Schmidt superheater, and only 160 lbs. of steam, had a load of 330 tons. At Borough Market Bridge a stop was barely avoided, so that 10¾ min. were required to pass New Cross (5 miles). Work on the severe grades was not quite so good as on other occasions, but the hard 11½ miles to Knockholt were covered in 20¼ min., and Tonbridge was passed in 45 min. from Charing Cross (29½ miles). The 26½ miles to Ashford took 30½ min.; Sandling Junction was passed 10½ min. later (9¼ miles), and the concluding 11 miles to Dover Town were covered in 12 min. Even then the time taken from Charing Cross was 98 min. instead of 95; but, in view of the signal check, weather conditions and other factors, the run was particularly good.

On another occasion No. 175 of the extended smokebox Belpaire class, had 310 tons in stormy weather. Signal checks near Spa Road caused 11¼ min. to be taken to pass New Cross. The summit at Knockholt was passed in 31¼ min. from the start, and Tonbridge in 45¾ min. The Tonbridge-Ashford section was covered in 29½ min., and Dover Town reached in 23 min. from Ashford (20½ miles), barely 98½ min. from London. On the 10 a.m. train No. 745, of Mr. Wainwright's earliest class, had a load of 300 tons, and was being operated by a driver who was strange to the particular engine. In the London area there was slight fog, and on Charing Cross bridge a stop was only just avoided. But New Cross was passed in 10¾ min., Knockholt in 31½ min., and Tonbridge reached in 47 min. The train calls at Tonbridge, and the new start is rather difficult; but Ashford was passed exactly in the booked 34 min. Signal delays caused a check at Folkestone Central, but the terminal siding beyond Folkestone Junction was reached in 103 min. from Charing Cross (71¾ miles), including one stop and the checks mentioned.

The 2.20 p.m. is regarded as one of the hardest of the Continental trains. Before Pullman cars were introduced, No. 75 of the latest non-Belpaire class, with a load of 310 tons, made a phenomenal run, the siding at Folkestone Junction being reached in 91 min. including a check in the London district. More recently, with 300 tons, No. 19, of the Belpaire extended smokebox class, stopped at New Cross owing to the alarm signal being pulled, and then covered the remaining 66 miles, start to stop, in 80½ min., with a slight check near Tonbridge, in addition to the usual slack. No. 36, a later engine of the same class, in her non-superheater days, reached the siding with 310 tons in 93 min., including one slight signal check.

For up trains the difficulties are somewhat different, though quite as severe. With the 3.20 p.m. from Dover Pier, No. 176, similar to No. 175 already mentioned, made a remarkable run with 330 tons in stormy



ONE OF MR. WAINWRIGHT'S FIRST EXPRESS LOCOMOTIVES.

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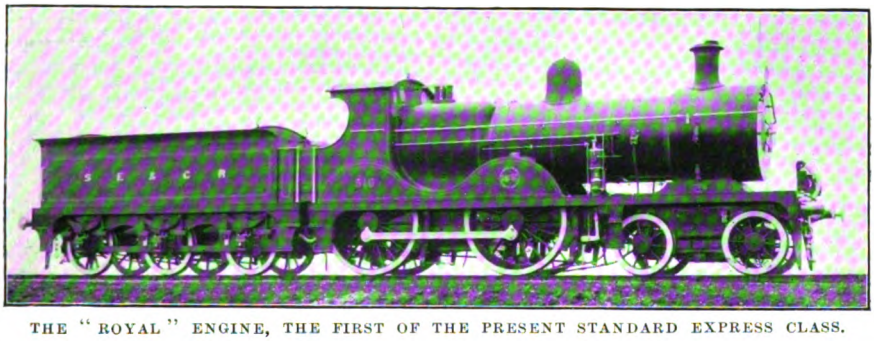
weather. Starting 2 min. late from the Pier, Charing Cross was reached exactly to time, although almost stopped outside the terminus. Reckoning from Dover Town station, passed through very slowly, the 12 miles to Sandling Junction—one long climb at an almost invariable grade of 1 in 266—occupied barely 20 min., and Ashford was passed in just 30 min. (20½ miles). Thence to Tonbridge took 29 min., and the hard ascent of 4 miles at 1 in 122, followed by 2 miles at 1 in 144 (most of the latter inside Sevenoaks tunnel where slipping is almost unavoidable) took 12 min., the commencement being made at reduced speed. A fall to Dunton Green is succeeded by a rise of 3 miles, mostly at 1 in 143, and the rest of the journey is easy, except for the inevitable slacks from St. John's onwards, and especially from London Bridge into Charing Cross. When passing London Bridge the time from Dover Town was only 96½ min. (74¾ miles), and although nearly 7 min. were taken to reach the terminus, 1¾ miles further on, the arrival was exactly according to schedule.

With the 1.40 p.m. from Folkestone Harbour, No. 491 of the first Belpaire class, made a splendid run with 320 tons in fine weather, except that fog in the London district entailed slackening rather earlier than would otherwise have been necessary. There were, however, no checks, the only difficulty being a hard start from Tonbridge on the curve and grade succeeding, after calling at that station as booked. The initial grade from Folkestone is 6 miles long, and Sandling Junction was passed in 10½ min., the 15¼ mile stage thence taking 21 min. Then followed a remarkable performance along the relatively easy, but still formidable 26½ miles to Tonbridge, the latter station being stopped at in only 28 min. from passing Ashford at speed. The climb through Hildenborough, in combination with the difficulties of the fresh start, required 17 min. to pass Sevenoaks; but the complete run into Charing Cross was made in 47¾ min., without any specially fast running, though 60 miles per hour was exceeded once or twice.

On a stormy night recently the 9.5 p.m. from Folkestone Harbour left at 9.16, and the start from the siding at the Junction was made at 9.25. The driver of No. 166, similar to Nos. 175 and 176 referred to, had, in addition to his own train, three vehicles bringing from Dover Ostend passengers, who should have travelled by the 7.55 train had the Belgian boat arrived to time. This made a load of about 350 tons, the heaviest the writer has known on these services. But Sandling Junction was passed in 11 min., and Ashford in 21½ min., while the Ashford-Tonbridge section occupied barely 29 min. Hildenborough bank constituted a difficulty, though Sevenoaks was passed in 15¾ min. from Tonbridge; but at London Bridge barely 90 min. had been required from the start (69½ miles) and the terminus was reached in 94½ min.—splendid work for such a heavy train in rough weather.



THE "ROYAL" ENGINE, THE FIRST OF THE PRESENT STANDARD EXPRESS CLASS.

The Chatham route is not now used by many of the Continental trains; but a run by the 11 a.m. when that route was followed may be mentioned. No. 737, another of Mr. Wainwright's earliest engines, had a load of 320 tons after the attachment of the City portion at Herne Hill, the weather being fine. Sole Street (22¾ miles) was passed in 33½ min. The succeeding descent to Rochester Bridge was necessarily taken carefully, owing to the sharp curves at the foot, and slow running has always to be continued for a mile or more beyond, in fact until clear of the Chatham tunnels. But including all delays, the 48 miles from Herne Hill to Faversham were covered in 68 min. Selling bank of 1 in 100 for 4 miles is always a formidable task, and

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MR. WAINWRIGHT'S FIRST CLASS OF PASSENGER TANK ENGINE.

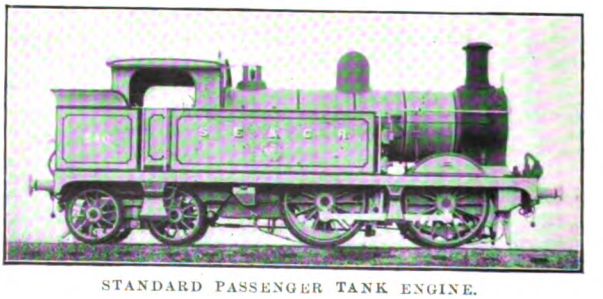
on this occasion fallen leaves caused slipping. Eventually a stop was made at Dover Harbour station in 104 min. from Herne Hill (74½ miles). On a return journey by the corresponding service (5.20 p.m. from Dover) since the route has been changed to that *viâ* Ashford, No. 502, of the non-Belpaire class, had 320 tons in bad weather. Ashford was then passed in 31 min. from Dover Town, Tonbridge (including a slight permanent way check) barely 28 min. later, and the final stage, with slacks for the connecting loop from Orpington to Bickley and checks at Beckenham Junction, Herne Hill and outside Victoria, took 45½ min. (31 miles).

On the Kent Coast services references may first be made to runs with the Cliftonville expresses with winter loads when first introduced in 1911. Leaving Victoria at 9.10 a.m. with 220 tons, No. 586, of the last non-Belpaire design, passed Herne Hill in 9 min., and Sole Street in 40 min. from Herne Hill—a maximum speed of 75 miles per hour being touched at Farningham Road. Faversham was passed at reduced speed in 61¼ min. from Herne Hill. Here two coaches were slipped, and on the easy Kent Coast line speed ranged high, though near Herne Bay a short section at stiff grade is encountered. At Birchington permanent way operations entailed a slack, and a special stop was made at Westgate, reached in 23½ min. from Faversham (20½ miles), and in 94 min. from Victoria (72¼ miles).

On the return journey, with the full load throughout, No. 506, of the first Belpaire class, stopped specially at Westgate, was delayed by permanent way operations at Birchington, while near Herne Hill signal checks were experienced. But Faversham was passed in 25¾ min. from Westgate, and Herne Hill in 86 min. The conclusion was somewhat spoiled by signal checks into Victoria and the late arrival of 4½ min. was entirely due to these causes. No. 746, fitted with Weir feed-water heater and pump, attempted the 90-min. schedule from Victoria to Margate West with 290 tons on the 3.20 p.m. relief "Granville" express, but the day was so stormy and slipping on the grades so continual that this result was impossible. Yet to make the run in 96½ min. entailed really splendid work. To reach Herne Hill took 9½ min., while Sole Street was passed in 39 min., Faversham in 70 min., and a bad permanent way check between that station and Whitstable explained at least 3 of the 6½ min. dropped. As it was, the 24 miles from Faversham to Margate took only 26½ min., and the whole run was a splendid example of working hard against adverse conditions.

Two runs with the 10.10 a.m. from Margate West—allowed 92 min. from Westgate to Victoria—may also be recorded. No. 493, (non-Belpaire class), with 290 tons, was checked near Whitstable for signals and for permanent way operations beyond, but Faversham was passed in 26 min., and Gillingham entered slowly 18½ min. later. The ascent from Rochester Bridge to Sole Street was made with remarkable steadiness, and the final run from the summit to Victoria, including bad checks at Shortlands, through Sydenham tunnel, approaching Herne Hill and outside Victoria, took 35½ min. On the same train, with a like load, No. 157, of the later Belpaire class, was checked beyond Whitstable, but passed Faversham in 25¾ min., was slightly delayed at Gillingham, checked through Sydenham tunnel, before and after Herne Hill, and almost stopped outside Victoria. All delays included, the run from Westgate was made in 97 min., the checks more than compensating for lost time.

It will, therefore, be seen that whatever may be their shortcomings, Mr. Wainwright's engines are not only required to



STANDARD PASSENGER TANK ENGINE.

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perform splendid work, but, in view of their moderate dimensions, habitually carry out arduous duties with satisfaction. Recent administrative changes have placed the responsibility for design, repair and materials of locomotives, rolling stock and mechanical equipment entirely upon Mr. Wainwright, while the working of engines, supervision of rolling stock in service, and the enginemen, mechanics and others at the running sheds, together with the examiners and carriage cleaners rests upon Mr. A. D. Jones.

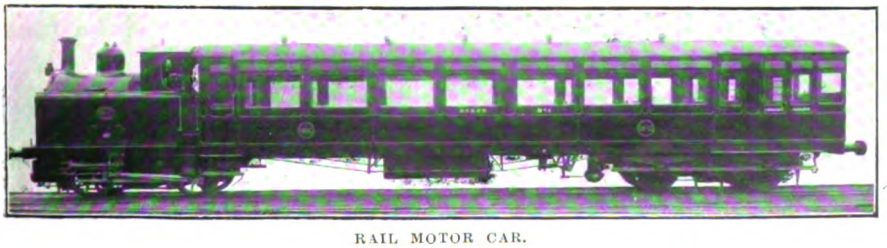
TANK ENGINE FOR LIGHT PASSENGER TRAFFIC ON BRANCH LINES.

Mr. Wainwright was born at Worcester on November 16th, 1864, educated at Worcester Grammar School, St. Andrew's, Derby, and the City and Guilds Technical Institute, Finsbury. In 1879 he began an apprenticeship on the Midland Railway, and spent about ten years on the Midland, South Eastern, and London, Tilbury and Southend lines, combining a training in mechanical engineering with locomotive and carriage designing, running and construction. At various times, in connection with two of the railways named, he held the positions of Locomotive Draughtsman, Foreman of various shops, Inspector of Rolling Stock and Materials, Works Manager, and Mechanical Engineer (Carriage and Wagon Department); and in January, 1899, was, as already stated, appointed Locomotive Carriage and Wagon Superintendent to the amalgamated South Eastern and Chatham Railways. For several years he was called in as Consulting Engineer by the Rolling Stock Trust, Ltd., with regard to the inspection of a large number of locomotives and carriages on the Great Central Railway.

Since November, 1898, Mr. Wainwright has earnestly and efficiently filled the position of Honorary Secretary to the Association of Railway Locomotive Engineers of Great Britain and Ireland, and he is now President of this Association. In January, 1904, he was appointed a magistrate of the county of Kent. He is also a member of the Institute of Civil Engineers, holds the rank of Major in the Engineer and Railway Staff Corps, R.E., is a member of Territorial Force Association of the County of Kent, and of the Order of the Royal Prussian Crown (Germany).

Mr. Jones, who was born on June 5th, 1871, at Tilford, near Farnham, was educated at Haileybury College and the Engineering School in Owens College, Manchester. He then became a pupil of Mr. J. A. F. Aspinall, at the Horwich Works of the Lancashire and Yorkshire Railway, and, after having been in charge of locomotive running sheds, outdoor carriage and wagon departments, and as assistant in the running department, was, in 1901, appointed Chief Assistant in charge of that department. He entered upon his present position on the South Eastern and Chatham Railway early in 1912. Mr. Jones is a member of the Institution of Mechanical Engineers.

The writer desires to acknowledge many courtesies on the part of Mr. F. H. Dent, General Manager, Mr. Wainwright, and Mr. Jones, and the kind co-operation of the latter gentleman in supplying the photographs and particulars necessary for this article.


RAIL MOTOR CAR.

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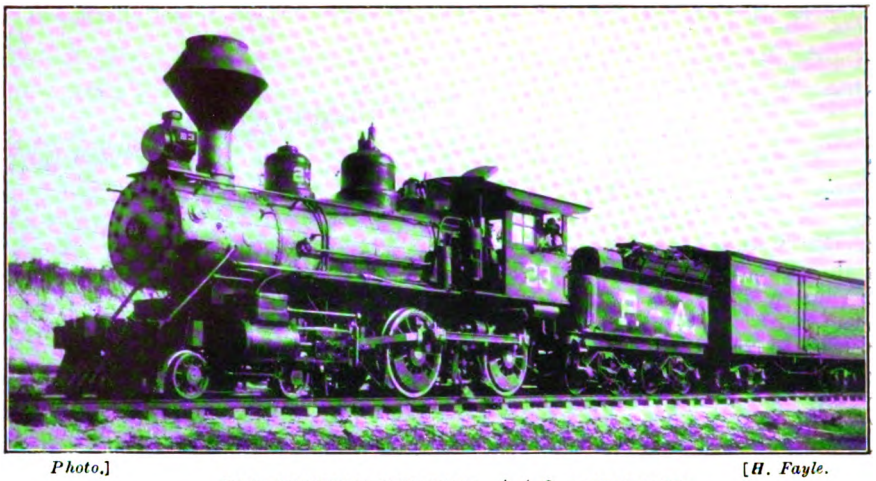

Photo.] [*H. Fayle.*

PAN-AMERICAN RAILWAY: 4-4-0 LOCOMOTIVE.

The Pan-American Railway.

By H. FAYLE.

THE Pan-American Railway is, as many think, destined at some future date, to form a link in through railway communication between New York and Buenos Ayres. But even if this result be delayed, it is quite within the bounds of probability that railway communication may be completed between New York and the Panama Canal. To the south the difficulties are well-nigh insuperable, and the inducements in the way of possible traffic small. The present Pan-American Railway consists of 458 kilometres of line traversing the Pacific coast-line of the States of Oaxaca (pronounced "Wahakah") and Chiapas, in Mexico. Gamboa, on the Tehuantepec National Railway, is the northern terminus, and the southern is Mariscal, on the Guatemalan frontier. Though an independent American concern, the railway is operated by the National Railways of Mexico—an amalgamation of the old National Railway of Mexico with the Mexican Central and some other lesser lines.

This part of Mexico is very little known, owing to the fact that communication with the other divisions of the republic has in the past been very deficient. The State of Chiapas, the most southerly in Mexico, has been for a time a portion of the neighbouring republic of Guatemala. It was inhabited from remote ages, and is believed by many to have been the cradle of the human race. Relics of pre-historic times remain, but they are seldom visited owing to their inaccessibility. In the past there have been several projects for railways in this region, but most of them have ended in failure. The Isthmus of Tehuantepec has always offered a favourable field to the railway promoter, and geographically presents a most favourable position for conducting a through service between the Atlantic and Pacific Oceans. In the journey from New York to San Francisco it has the advantage of 1,269 miles over the Panama route, though, of course, the railway portion of the journey (190 miles) is greater than the 20 miles at Panama. Another advantage is the fact that at this particular point it is only necessary to surmount an elevation of about 800 ft. in crossing the watershed. To the north the great Mexican plateau attains in places a height of more than 8,000 ft., while to the south the Sierra Madre mountains rise abruptly from the Pacific coast to 3,000 ft. or more.

As early as 1848 surveys were made for a trans-isthmian railway from Coatzacoalcos, on the Atlantic to Salina Cruz, on the Pacific. Various concessions were granted at later dates, but nothing was done until 1888, when a concession was obtained by Mr. Edward McMurdo, of London, and eventually in 1894 the line, in an incomplete

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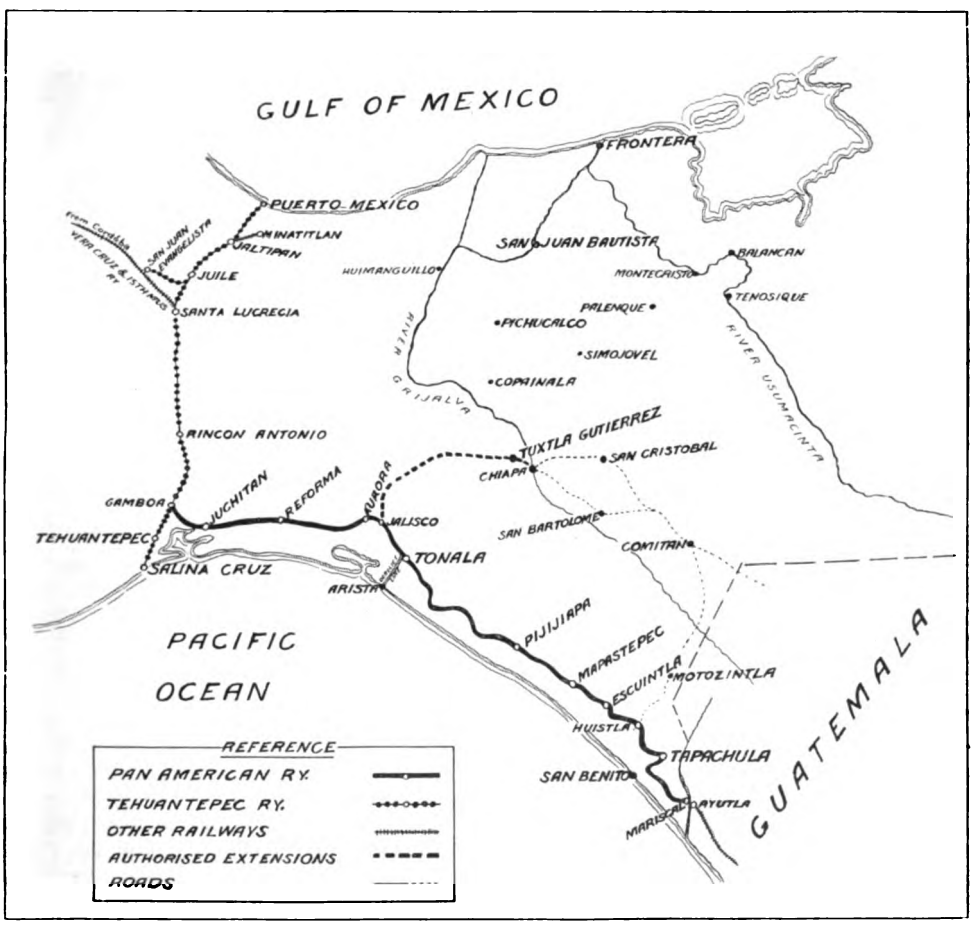
state, was opened for traffic. It had unfortunately been very lightly constructed, and the facilities at the terminal ports left much to be desired. Reconstruction was found necessary, and the contract for the work was in 1899 let by the Mexican Government to Messrs. Pearson & Son. The new port works at Coatzacoalcos and Salina Cruz were completed and the line reopened in January, 1907. A full account of the modern line appeared at the time in the RAILWAY MAGAZINE. A number of railway charters were granted by President Diaz from 1876 onwards to the governors of the various States of the Republic, giving them the right to organise companies and to build railroads, each charter carrying with it a Government subsidy of 12,880 dollars (gold) per mile. In a great many cases, such as the two here mentioned, the railways were never completed, and the money seems to have been diverted to political purposes. An English company—the Mexican and Central American Railway—had obtained concessions for the construction of two railways. One—the Northern—started at the port of Vera Cruz, and continued along the Gulf Coast to the port of Minatitlan (near Coatzacoalcos), connecting with the Atlantic end of the projected Tehuantepec Railway, while the other—the southern—connected with the Pacific end of the same line, and ran along the coast to the Guatemalan frontier.



Another company, the Mexican Pacific, registered in London in 1888, had obtained a concession for a line from Puerto Tonalá or Arista, on the Pacific Coast, to the port of Frontera, on the Atlantic, passing through the towns of Tuxtla Gutierrez and San Cristóbal Las Casas. The ascent of the Sierra Madre to San Cristóbal, which stands at an altitude of nearly 7,000 ft., involved some difficulties, and it was not surprising that the only part of this ambitious scheme

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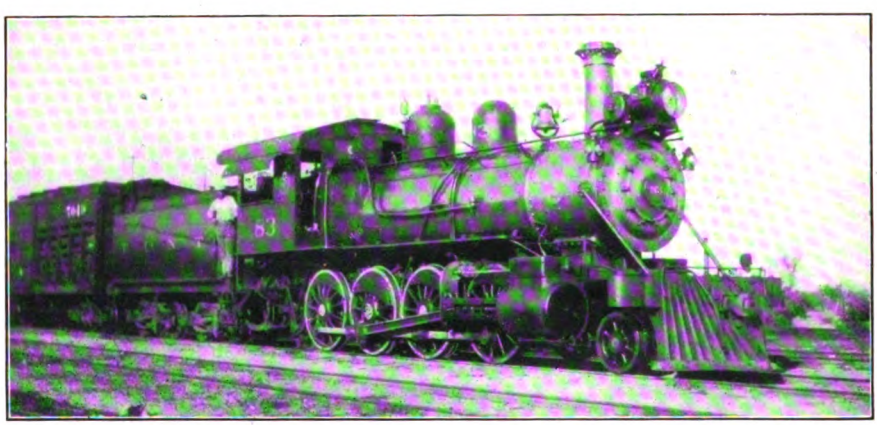
actually completed was the level portion from Arista to Aurora, at the base of the mountains, a distance of 30 miles only. The Mexican and Central American, which would have connected with this line near Tonalá, met with no better fate; and beyond an insignificant 44 miles at the Vera Cruz end, extending to Alvarado, the scheme was abandoned. This section of line was afterwards sold to another company, and is now known as the "Vera Cruz (Mexico) Railways, Ltd.," possessing some half-dozen locomotives, and a few steamers which ascend the River Papaloapam.

The Pacific Coast of Mexico is very badly supplied with harbours. On the Chiapas coastline the only two are Arista and San Benito, both of which have always been open roadsteads. The former had the advantage of the short section of line already mentioned, which connected it with the town of Tonalá, 12 miles inland, and continued on to Aurora. But even this little track had the effect of making Tonalá a distributing centre of some importance. The interior of the State was poorly supplied with roads, and such as they were these could not accommodate wheeled traffic. Therefore everything had to go on muleback. The principal road was one constructed by the Spaniards, extending along the coast to the Guatemalan frontier. Passengers and freight usually proceeded by steamer from Arista to Acapulco or Manzanillo, from either of which to reach the railhead another long journey had to be made on muleback, so that the journey from Mexico City to Tonalá often occupied nearly 17 days. In 1894 the opening of the Tehuantepec Railway considerably simplified matters, and about the same time the State Government of Chiapas undertook the construction of a carriage road from San Geronimo, on the railway, through Juchitan and Aurora, to Tuxtla Gutierrez, which had become the State capital in 1891. This road was subsequently extended to the important towns of San Cristóbal (the old State capital) and to Comitan. For the time being this became the principal means of communication, though as yet the Tehuantepec Railway was not connected with the Mexican Railway system.

Construction of the Vera Cruz and Pacific Railway (or, as it is now known, the Vera Cruz and Isthmus Railway) supplied the want, the line extending from Santa Lucrecia, on the Tehuantepec Railway, to Cordobá, on the Mexican Railway, with a branch from Tierra Blanca to Vera Cruz. Although very lightly built, the working of this line did not fulfil expectations, and it is now operated by the national Railways of Mexico. About 1900 the present Pan-American Railway was incorporated to construct a line from San Geronimo, on the Tehuantepec Railway, to the Guatemalan frontier, over substantially the same course as the defunct Mexican and Central American Railway. The concession also included the construction of a branch line to Tuxtla Gutierrez and Chiapa. Steady progress has since been made, and the main line has been opened in sections as completed. The last part from Tapachula to Mariscal, on the Guatemalan frontier, was finished in 1910, and the full service of trains inaugurated in January, 1911.



Photo] [*H. Fayle.*

TEHUANTEPEC RAILWAY: "CONSOLIDATION" LOCOMOTIVE.

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The Pan-American Railway begins by a junction with the Tehuantepec Railway at Gamboa, 1 kilometre north of San Geronimo. A new station, the largest on the line, has been built here, housing the local administrative department of the railway. A short distance away there is a further junction, so that through traffic from Salina Cruz can be dealt with direct. The triangle is also used for turning the locomotives. Locomotive turn-tables are not much used in Mexico. Triangles are employed instead, and it is the custom to run, not merely the locomotive but the whole train, round the triangle, so that it may be round the right way for starting out again. This operation is usually performed before entering a terminal station, and at many of the important termini (*e.g.*, Guadalajara) locomotives never enter the station at the head of the train.

From Mexico City to San Geronimo the journey is at present rather tiresome and slow, as the lines of three different railways have to be traversed. A sleeping car is, however, run through from the capital to Salina Cruz. These cars—some are built and owned by the Mexican Railway, others by the Pullman Company—are of the type known in America as "Broiler-Buffet Cars," that is to say, they possess in addition a small kitchen, from which *á la carte* meals can be served when the berths are folded up. There are no proper dining cars on any of the Mexican railways, but the trains make regular stops of 20-30 minutes for meals, and as these cost 2s., considerably less than in the sleeping cars, accommodation in the latter is not much availed of. Leaving the Buenavista terminus in Mexico City at 8.15 p.m., the journey (198 miles) is over the Mexican Railway to Cordobá, which is reached at 5.25 a.m. It is continued at 8.30 a.m., over the Vera Cruz and Isthmus Railway, and Santa Lucrecia is reached at 9.45 p.m. (203 miles). Thence the Tehuantepec Railway takes on the car at 11.45 p.m., reaching Gamboa at 5.55 a.m., and Salina Cruz (114 miles) at 8.5 a.m. Thus the average speed for the whole journey is only 14·3 miles per hour. It must, however, be noted that through traffic is very small, while except on the Mexican Railway all trains are run mixed.

There is but one mixed train daily over the Pan-American Railway. This leaves Gamboa at 8.45 a.m., after the arrival of the trains from Mexico and Salina Cruz. It reaches Tonalá at 5 p.m. the same evening, and the journey is continued at 5.30 next morning, Mariscal being entered at 6.30 p.m. in the evening. The average speed is, therefore, about 13 miles per hour, but as the line was very lightly constructed, and the stops are long, a higher rate of travelling is not at present possible. The line is, however, being strengthened by the addition of extra sleepers, while the light bridges are being rebuilt, and when these improvements have been completed the running time will be improved. The author was informed that the through "sleeper" from Mexico will then probably run to Tonalá, instead of to Salina Cruz, and that the connections will be smartened up, so that the arrival (at Tonalá) will be in the morning, instead of in the evening, as hitherto, while Mariscal will be reached the same evening—a saving of 24 hours. The train usually consists of a combination baggage express and post office car, composite first and second-class coach, and some freight vehicles. Prior to 1907 some of the Mexican railways provided three classes of passenger accommodation, but now third-class is abolished and the second-class rates were altered to correspond. First-class coaches, exactly similar to the American day cars, have reversible seats for two on each side of the central corridor; second-class are unupholstered, and only used by the natives. Rates vary from 3 to 4½ cents a kilometre in the first, and generally half these amounts in the second (4 cents equal 1d.).

The town of San Geronimo, the starting point of the line, owes its existence to the Tehuantepec Railway. It possesses a brewery and an oil refinery. Beyond there is nothing but a single unpaved road, with a few houses, occupied chiefly by those whose business keeps them in this rather unattractive spot. The older native town, nearly a mile from the station, consists of a curious collection of primitive mud huts, thatched in some cases with palm leaves. This part of the country strikes one as being very dry and sandy, while the heat during the middle of the day is intense. After leaving Gamboa the line runs through a dry, dusty district, in which cacti and mimosa are the principal forms of vegetation. To the north the rather nondescript range of mountains called the Sierra Madre are visible. The line for the most part follows the old "Camino Real" (Royal Road) of the Spaniards; but the latter is no better than a rough earth track, along which the cumbrous oxcarts of the farmers slowly

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wend their way. Approaching the town of Juchitan, the land is better cultivated. The soil is said to be very fertile, and large crops of maize and other cereals can be raised with little trouble. Great quantities of salt are also evaporated from lagoons bordering the ocean.

Juchitan, with a population of 16,000 is an important military and distributing centre for the surrounding country. On the arrival of a train the station becomes a scene of great animation. Dusky-hued native vendors, principally women, gather round the carriage, offering a variety of fruits and comestibles for sale. Consisting mostly of flat maize cakes, called "tortillas," frijoles (black beans), and other delicacies, the eatables are not much relished by foreigners, more especially when the conditions under which they are prepared are taken into account, but they are nevertheless consumed with great relish by second-class passengers. After leaving Juchitan, a flat and featureless run brings us to Union Hidalgo, a depressing collection of mud huts, and the point of departure for a large sugar plantation to the north. Beyond, the country is more broken, and we soon cross the River Ostuta by a fine bridge 735 ft. in length, to reach Reforma, where there is a railway restaurant, and the train stops for half-an-hour. Here, too, we cross the down train from Tonalá. As this station is usually reached about midday, the heat is probably nearly 100 degrees in the shade. The restaurant is a primitive establishment, built of mud, and $1 (2s.) is charged for a most indifferent meal, cooked and served by natives.

Thence the line trends inland, and we get a better view of the mountains, many of which are so thickly covered with Scotch fir and scrub that their summits are inaccessible. The next station, Chahuites, is the starting point for the town of Tapana, with a population of 2,000. Beyond, the grade is upward, and, after passing through a densely wooded valley, we reach Aurora Station, formerly of importance as the starting point of the only road communicating with the interior of the State, and crossing the mountain range by the pass of San Fernando. Most of this traffic is now sent from the next station, Jalisco, as a newer and more direct road has since been constructed from this point to join the older road in the Cintalapa valley. This, a carriage road carried over the mountains by the pass of La Sepultura, was intended to serve as the route of the projected branch railway to Tuxtla Gutierrez. It has a splendidly engineered ascent, and crosses the mountains at an altitude of 2,700 ft., thence descending into the fertile valley of Jiquipilas, where large haciendas are devoted to the cultivation of the "Henequen," a species of cactus, the leaves of which are used for making fibre.

Photo] [*H. Fayle.*

GAMBOA STATION, PAN-AMERICAN RAILWAY.

The distance by this route from the railway to Tuxtla Gutierrez, the capital of the State, is 129 kilometres. This city has a population of 10,000, and 15 kilometres beyond is the town of Chiapa, with 6,000 inhabitants. Still further is San Cristóbal, the old capital of the State, with 13,000 inhabitants, dwelling at an altitude of nearly 7,000 ft. The road continues to the city of Comitan, which has a population of 10,000. When the road was first opened an automobile service

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was started, but it was soon abandoned as the road quickly fell into a bad state of repair. There is now no public service, and the few travellers whose business takes them there have to hire a vehicle or ride. The journey to the capital occupies three days, while to Comitan at least a week should be allowed. Goods are conveyed in the native oxcarts, which usually take a week on the journey to the capital, though this service is often interrupted in the rainy season. Traffic for places beyond is carried on mule-back.

A run of about 14 miles from Jalisco brings us to the city of Tonalá, a town of 6,000 inhabitants, rather picturesquely situated at the base of the mountains. Since the opening of the Pan-American Railway this place has been rather supplanted by Jalisco as a distributing centre.

Photo] [*H. Fayle.*

RAILWAY BRIDGE, SAN GERONIMO.

Arista, the port of Tonalá, has been abandoned, and the railway connecting it with Tonalá has been removed. Travellers have perforce to spend the night at Tonalá, as the train from Gamboa there ends its journey, and there is no connection till next morning. South of Tonalá the scenery assumes a more tropical aspect. Much valuable timber—mahogany and hardwoods—is as yet quite undeveloped, while so dense is the jungle in places that sunlight does not penetrate. The land is extremely fertile, and will grow almost anything, from rubber to pineapples or bananas, though, of course, the labour of clearing it is a serious item. The rainfall increases the further south we go, and reaches over 100 inches annually at Tapachula, most of the fall being between June and October. The line crosses numerous small rivers, but these seldom reach the sea, and generally disappear in the marshy "pampas" bordering the coast. The presence of these swamps, coupled with the intense heat of the day, make the climate rather unhealthy for Europeans, malarial fevers and smallpox being very common. Higher reaches of the mountains are healthier, and at altitudes above 2,000 ft. coffee is grown extensively, the prevailing conditions being very favourable for its cultivation.

The line passes several small towns of which Pijijiapa and Mapastepec are the most important, though both are no better than sleepy little native villages. Inherently lazy, the Mexican farmer and his family will live on next to nothing. He cultivates only just sufficient land to supply his needs. Crops such as "henequen," which demand little or no attention or irrigation, are consequently more popular than others requiring more labour. There is an indifferent railway restaurant at Escuintla, where the train stops half an hour. The next place of importance is Huistla, a distributing centre for the interior, and the starting point of a mule track which leads through the insignificant towns of Motozintla and Chicomuselo, to the city of Comitan. Thence the line runs through some fine grazing country to the important town of Tapachula, with 7,000 inhabitants, and an important receiving centre for the products of the coffee plantations. Picturesquely situated at the base of the great volcano of

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Tacana, the mountain is a prominent landmark for more than a hundred miles. The railway here bends sharply round, the original intention having been to terminate at the neighbouring port of San Benito. For some reason, however, this portion has not been completed, and the railway runs instead to Mariscal, on the Guatemalan frontier.

Here the River Suchiate forms the boundary between the two republics. The Guatemalan railway system starts at Ayutla, on the other side of the river, but through communication with Guatemala City is not yet complete. The railway bridge over the river is completed, but, unfortunately, this portion of the Guatemalan railways has been laid on the metre gauge, while the Pan-American Railway is on the standard 4 ft. 8½ in. gauge, so that through cars cannot run beyond the frontier. This section of line at present terminates at Vado Ancho, but, with some other lines in Guatemala and Salvador, it now forms a portion of the system of the International Railways of Central America. Construction of the short connecting link from Vado Ancho to Las Cruces is proceeding. Las Cruces is already connected by rail with Guatemala City. There is another railway extending from Guatemala City to Puerto Barrios, on the Atlantic, constructed on the 4 ft. 8½ in. gauge. Whenever the Pan-American Railway be carried further south, it will be constructed along the Pacific Coast through San José (Guatemala), San Salvador (Salvador), Amapala (Honduras), Leon (Nicaragua), and so on through San José (Costa Rica) to Colón, at the eastern end of the Panama Canal. When the authorised line to Tuxtla Gutierrez is constructed, it is very probable that it will be carried through the important towns of San Cristóbal and Comitan to join the Guatemalan railway system, thus affording an alternative route to Guatemala City.

The interior of the State of Chiapas is considerably drier than the coast, but the valleys are fertile. Cattle breeding and cultivation of the "henequen" can therefore be carried on to advantage. The Atlantic slope is extremely moist; the rains last from March to the end of November, and the hot climate will raise almost anything. A line is already under construction from Santa Lucrecia on the Tehuantepec Railway to Campeche in Yucatan, to link up the railways of Yucatan with the other lines in Mexico. Communication in this district is carried on principally by means of light draft steamers, which ascend the rivers Grijalva and Usumacinta. The Pan-American Railway owns 25 locomotives of two distinct types, 4-4-0 and 4-6-0. Both are lightly constructed American machines, with small driving wheels, and utilising wood as fuel. When the Guatemalan railway system has been completed it will be possible to travel from Mexico City to Guatemala City in about 2½ days, and from New York in a week. There is at present no tourist traffic, such places as Reforma and Pijijiapa being about the last that any tourist would choose as a holiday resort. It is possible, however, that Guatemala City may attract some people in the future. Standing at an altitude of over 3,000 ft., it is said to possess a very pleasant climate during the winter, or dry season, from November to March.

The British Consul at Buenos Ayres, in his latest report, makes the following reference to the important enterprise described by our correspondent:—"The most interesting feature in connection with railway construction is perhaps the gigantic scheme that is receiving the support of the Department of State at Washington, spoken of as the Pan-American railway enterprise, by means of which it is sought to bring New York into intimate touch with Buenos Ayres, altogether over 10,116 miles of railways. Some prominent United States financiers have recently visited this capital, it is believed, in connection with the advancement of this project, which will, of course, be accomplished by the linking up of the existing systems of the various South American Republics. The realisation of this scheme will involve the building of some 3,700 miles of railway, for which no doubt United States capital will soon be forthcoming. This colossal undertaking appears to be considered financially feasible, yet it can hardly prejudice British carrying trade interests to any great extent. Railways have not yet been known to successfully compete against sea-borne commerce, and even viewed from the standpoint of passenger traffic, a lengthy railway journey across the tropics will always remain a disagreeable ordeal."

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Photo] [*F. E. Mackay.*

LONDON BRIGHTON AND SOUTH COAST RAILWAY:
The "Southern Belle," drawn by No. 422 (fitted with Schmidt superheater).

Modern British Restaurant Car Services.

[No. I.]

By "VOYAGEUR."

IT would, I think, be correct to say that no detailed survey of modern British restaurant car services has yet been published. The advent of each marvel of the coach-builder's art has been duly chronicled; the inauguration of new restaurant car expresses has received an adequate share of attention in the railway press; but a comprehensive review of the methods of the different companies, their modes of catering and the character of the accommodation provided, with some inquiry as to the services now in operation, has not, as yet, been undertaken. As a constant traveller in all parts of the country, frequently dependent on the facilities of the travelling restaurant, I may perhaps be allowed to claim the necessary qualification for attempting such a task.

Perhaps few readers have any conception of the enormous extent and widespread ramifications of restaurant car business in the present day. When preparing the table which will accompany a later instalment of this article, giving the number of restaurant car expresses running daily on each line in the British Isles, I took occasion to inquire of several enthusiastic students of "Bradshaw" and other encyclopædic works of like character what figure they would hazard as the grand total for such services. The guesses ranged from 100 to 200, and I daresay that even my own estimate would not have ranged much higher than the latter figure. Yet the total is no less than 457! Were the number of services on each line added together, we should actually reach a figure of 560, but this would include a double or treble counting of jointly worked trains which travel over more than one system daily, and also of trains which are worked through to destinations on "foreign" lines. Thus the grand total of individual restaurant-car expresses in operation daily in the British Isles numbers 457, of which 44 are jointly worked. These figures, it may be said, were culled from the summer time-tables (July to September) of 1912. Even throughout the winter months the total is as high as 403 trains. The London and North Western Railway alone serves more than a million meals on its trains annually.

There is nothing else the world over to compare with such figures as these. Whereas

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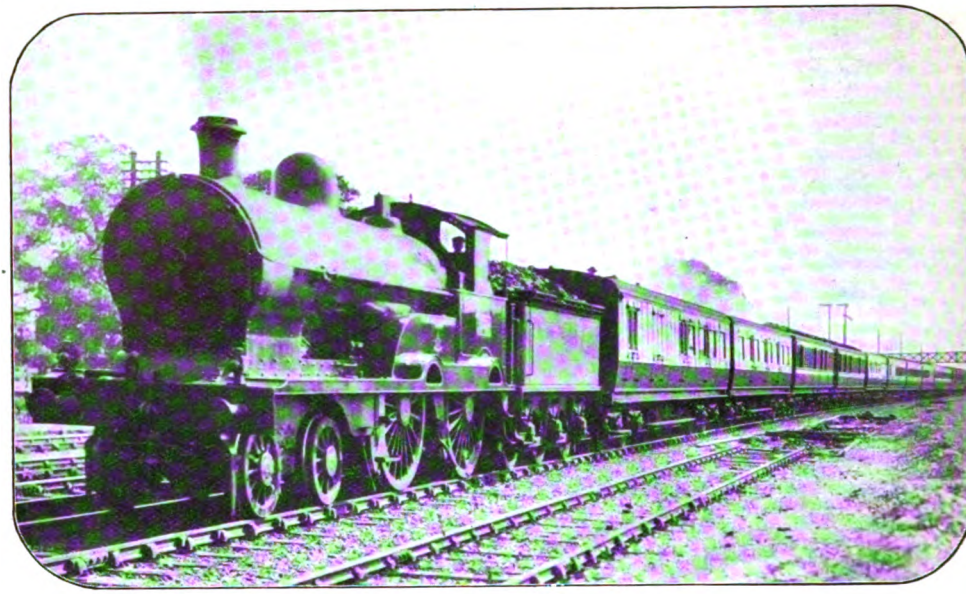

Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY:

12.10 p.m. Down Liverpool and Manchester Luncheon Car Express.
Superheater Locomotive No. 1294, *F. S. P. Wolferstan.*

on the Continent and in America the restaurant and the sleeping car has been introduced more with the object of securing the traveller the comforts of an hotel on very long journeys, in these islands restaurant car accommodation is provided on trains the total journey of which in some cases is encompassed within one brief hour, or little more. Three classes of passenger are in the main catered for—first, the long distance traveller; second, the traveller on pleasure or holiday; and third, the business man. To the first of these classes a meal of some sort is more or less a necessity, and the railway company's ample facilities are usually sought in place of taking a large supply of provisions. To the second the "meal on wheels" is more in the nature of a luxury, and the excuse of holiday-making, together with the novelty of the repast, are generally enough to warrant what would be considered an inordinate extravagance if partaken on *terra firma*. No qualms as to cost, however, afflict the third of the classes named, which is able to attribute to business expenses any expenditure so incurred. A recent development of this side of restaurant car operation has been the provision of cars on long-distance residential train services to or from large centres of population, the pioneer and principal exponent of this lucrative branch of railway catering being the Great Eastern Railway. In these cases the principal meals served are light breakfasts on the journey to town in the morning, and teas on the return journey at night.

It is difficult to know whether to attribute the spread of the restaurant car business more to competition than to enterprise. In certain cases, such as that of the Great Eastern, whose services have expanded from 6 in the early part of 1904 to 33 on the summer service of last year—an increase in eight years of 550 per cent.—enterprise alone must be responsible, in view of the fact that the districts served by this company during nine months of the year are almost purely agricultural, and not of a commercial, an industrial, or even a holiday character. Indeed, the tendency of the present day is for the restaurant car to become one of the stage properties of the advertising or publicity department of the railway, rather than an adjunct of the hotels department, the line that can boast the most palatial travel for its travellers commanding the most patronage. Particularly is this the case with business men, for, as the late Mr. C. H. Grinling pointed out in his excellent treatise on *The Ways of our Railways*—"a very

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large proportion of the travel over our railways is of choice rather than of necessity, and the fact that one can breakfast, lunch, or dine on the train often turns the scale in favour of going oneself instead of trusting to correspondence to achieve the end desired. Thus it is," he continued, "that the restaurant-car, first adopted on competitive routes in order to 'steal a march' upon a rival railway, is now coming into general vogue on all long-distance trains, whether on competitive routes or not." Whether the restaurant car pays its way, particularly in the cost of dead-weight haulage, it is difficult to say; but as an advertisement it is certainly a very valuable asset.

The first restaurant car employed in this country was inaugurated by the Great Northern Railway in their London and Leeds service on November 1, 1879. Prior to that date it had been possible to secure light refreshments on the Pullman cars which the Midland Company introduced in 1875, but there was nothing served in the nature of a *table d'hôte* meal. The Great Northern car was of course, for the use of first-class passengers only, and it formed part of a train from King's Cross corresponding to the present 5.45 p.m. express. In 1882 the Midland followed the Great Northern—a case of competition pure and simple—by putting dining cars on their London and Leeds service, and shortly afterwards the London and North Western, Midland and Great Northern companies introduced dining cars on the trains between London and Manchester. To the Great Eastern Company belongs the distinction of having been the first to cater for the "inner man" of the third-class passenger, a dining car for both first and second-class travellers being inaugurated on the north-country boat express between Harwich and York in the year 1891, becoming first and third on the abolition of second-class on the Great Eastern Railway on January 1, 1893.

Curiously enough, the long-distance train services of the country were by no means the first to enjoy the privilege of restaurant-car accommodation. On the three Anglo-Scottish routes spacious refreshment rooms had been provided at certain half-way stations—on the West Coast route at Preston, on the East Coast at York, and on the Midland at Normanton. At these the through trains were arranged to stop for twenty minutes, and *table d'hôte* meals were then in readiness. But whether it was owing to the genial heat at which the food was served, or the short time available for consuming it, few passengers got much beyond the first course. The companies concerned were, however, loath to exchange the assured profits of the refreshment rooms for the more uncertain revenue to be derived from restaurant cars. But even if delayed, the change was inevitable. Accordingly, in the summer of 1893 first and third-class dining

Photo] [*F. E. Mackay.*

GREAT EASTERN RAILWAY:
5.3 p.m. down Tea Car Express for Southend.

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cars appeared on both East and West Coast afternoon trains, although it was not until August 1, 1900, that the morning expresses leaving London, Edinburgh and Glasgow at 10 o'clock, were provided with like facilities.

A more curious case than this was that of the Great Western Company, which in 1842 entered into a 99 years' agreement with the Swindon Junction Hotel Company to stop all trains at least 10 min. at that important junction, so that passengers might obtain refreshments. Of course, as soon as travel began to be expedited, this compulsory stop was found to constitute so intolerable an obstacle to the acceleration of train services that the decision to buy the hotel company out became imperative. This was done in 1895 at the enormous cost of £100,000, the original capital of the hotel company. Strange to relate, the abandonment of this stop for refreshments on October 1 of that year by no means led to a rapid extension of restaurant-car facilities on the Great Western Railway. Indeed, as late as 1903 first-class restaurant cars only were run, and even these were few in number. This lack of enterprise seemed all the more noteworthy in consideration of the fact that the corridor train, without which restaurant-car accommodation would be of but little value, owes its inception to the Great Western Railway as far back as March, 1892. Any delinquencies in this respect have, however, been more than atoned for during recent years, as that company has with unparalleled strides overtaken every competitor in this particular sphere, and now proudly heads the list with no fewer than 88 trains running daily in the summer and 82 in the winter over its system with restaurant cars attached. I doubt whether any other railway in the world could show a similar figure.

Another striking example of enterprise in this direction is the Great Eastern Company. In many directions the Great Western has not had the incentive of competition in regard to the luxury of its travel, but has raised the facilities of non-competitive routes to the level of those on the routes where competition is experienced. The Great Eastern, however, has had really no competition at all to face. Purely commercial traffic on the Great Western is confined principally to the South and North Wales routes, that in many other directions being mainly of a holiday character. On the Great Eastern line, however, the summer traffic is of the holiday character, pure and simple. It is, therefore, a hall-mark of remarkable enterprise to see such a line coming higher on the list of restaurant trains run than, for instance, the Great Northern or the London and South Western lines. During the winter months the figures are yet more surprising, as the Great Eastern holiday traffic has then become virtually non-existent—the East Coast being regarded by most people as somewhat too bleak for winter holidays—so that there are only the modest demands of agricultural districts

Photo] [*H. T. Worlock.*

GREAT EASTERN RAILWAY:

11.45 a.m. Down East Anglian Luncheon Car Express.
4-6-0 locomotive (Schmidt superheater) No. 1500.

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PULLMAN BREAKFAST AND DINING CAR *Shamrock*:
Folkestone-Flushing Continental Service, South Eastern and Chatham Railway.

to be considered. In these circumstances the winter total of 29 restaurant car trains is highly creditable, but it should be noted that many of these are accounted for by the Great Eastern Railway speciality of catering for London business men resident in the country, to which attention has previously been called. The table to which I have alluded reveals the astonishing fact that on the winter train service the Great Eastern takes fourth place in the country as regards restaurant cars, excluding those worked by foreign companies. It is only beaten by the Great Western, London and North Western and Midland Railways, holding a substantial margin over all rival lines lower in the scale.

The other railways of the country have all added such facilities to their services by degrees, under the influence of competition, both direct and indirect, and have thus built up a service of restaurant-car trains which is without parallel in any country in the world, more particularly when the relatively small area of the British Isles is taken into consideration. My review also includes Pullman Car services, as practically all these cars are now equipped for the service of light meals, and in some cases also for *table d'hôte* breakfasts, luncheons, and dinners. The Pullman Car was first introduced into this country by the Midland Company in 1875, but it has not yet succeeded in establishing itself as a vehicle for long-distance travelling. On the line of its inception the Pullman Car is now a thing of the past, save that certain of the obsolete vehicles may be seen doing duty as rail motor cars and even occupying the still humbler position (minus their wheels) of platelayers' huts or other erections at the line-side. For shorter journeys, however, the Pullman coach has proved itself a decidedly popular means of transit. The leading line employing Pullman cars is the London, Brighton and South Coast, which began the use of these cars in 1879, and has now no fewer than 46 trains so equipped running daily. Four of these—the well-known "Southern Belle" expresses—are composed exclusively of Pullman cars, the complete train of seven vehicles having cost £25,000 to construct, and being probably one of the most luxurious trains in the world.

The South Eastern and Chatham Company has also recently instituted on the boat trains a service of Pullman Cars, which are now so extensively patronised that it is no uncommon sight to see three of them coupled together on the more important services. On the Flushing night service (*via* Folkestone) there are special Pullman restaurant-cars, on which *table d'hôte* dinner and breakfast are served. The two American car trains, introduced in 1892, to run between London and Folkestone and Hastings, are also included in the totals, as one is able on them to secure tea and other light refreshments. These, however, are not Pullman cars, although built somewhat after the same fashion. First, second and third-class passengers are conveyed by them, and no supplementary fares are charged. The only other line at present using the Pullman car is the Metropolitan, and one now may witness the somewhat strange spectacle of passengers taking afternoon tea in luxury while travelling round the "Circle," as these cars on their journeys to Chesham and Aylesbury make use of the Underground route from Liverpool Street to Baker Street. An early supporter of the Pullman car which has now abandoned this type of vehicle in favour of the more popular corridor restaurant-car train was the London and

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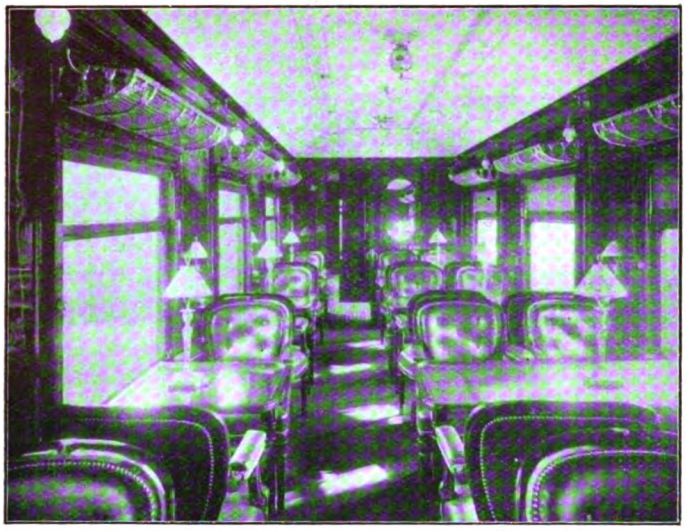

PULLMAN BREAKFAST AND DINING CAR *Shamrock* :
Folkestone-Flushing Continental Service: South Eastern and Chatham Railway.

South Western Company, and some of the Pullmans which were once in use on that line have been disposed of to the London, Brighton and South Coast Railway. It hardly need be said that the use of Pullman cars is limited to first-class passengers, while the only non-British feature about them is that a "supplement" is charged as a royalty by the Pullman Company, this being a shilling except in the case of the South Eastern and Chatham Railway, where half-a-crown is levied.

I will now proceed to a comparative survey of the methods adopted by different companies in regard to accommodation and service. The first question is that of the extent of accommodation provided for passengers taking meals. This is an important point, as it generally decides whether the car or cars can be employed as passenger-carrying vehicles or not when the accommodation of the train is limited. That is to say, when only one composite car is available, passengers proceed to the restaurant in as many "relays" as may be required for their meals, and afterwards return to their travelling compartments. On a long journey such an arrangement certainly has its advantages. It renders possible the use of smaller and less weighty "plant," with a reduced staff. This plan has, however, the serious disadvantage of adding to the train at least one heavy vehicle, weighing about 40 tons, which cannot be used for the conveyance of passengers. The Great Western Railway is the principal line using this type of car, which is also employed on the West Coast joint train services and certain others of the London and North Western Railway. In all these cases the cars are kept locked from the train, with the disadvantage to the passenger that light refreshments are not to be obtained between the serving of the regular meals.

The alternative and more general procedure is to utilise the restaurant cars as passenger vehicles, and to allow the passengers to occupy seats in them throughout the journey. Extra seating accommodation is, of course, then rendered unnecessary, but the chief gain to the railway company is that the only extra weight added to the train is that of the kitchen section of the restaurant car and the various cooking utensils. There are several other manifest advantages. When necessary, especially on shorter journeys, a larger number of people may be served at one *table d'hôte*; or, on the contrary, if the number of passengers taking meals be small, the tables of only a portion of the cars need be laid out, leaving the remainder for the accommodation of ordinary passengers. Arrangements being in this way more or less "elastic," the weight of the trains may be kept at the lowest possible figure, as the occupation of all seating accommodation, including that of the restaurant cars, is thus ensured. The disadvantage of the plan is equally obvious. It is that, where two or more servings of a meal have to be arranged, it is probable that the passengers whose seats are in the cars will have to leave them temporarily after they have had their own meals in order to make room for others. Speaking from personal observation, however, I do not consider this at all a serious disadvantage, and it is a rare thing to observe passengers raising difficulties about their temporary ejectment, as to many the brief perambulation of the train, or change of seats, comes as a welcome diversion on a long journey. As a matter of fact, owing to passengers joining the restaurant cars for short distances

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only, or to the additional servings of meals being at less popular hours and consequently not so well patronised, it frequently happens that the various relays may be served with scarcely any disturbance of those whose seats are in the cars throughout. Seeing that at least three-quarters of the restaurant-car trains running in the British Isles are arranged in this way, it is evident that the plan is generally the more satisfactory and economical.

Restaurant-car accommodation provided by the different railway companies is naturally very varied in character. In the great majority of cases the cars are run in pairs, one first-class and one third—one car containing the kitchen, and the other the pantry, the kitchen and pantry ends of the two cars being adjacent. This is the general arrangement on the Midland, Great Northern, London and North Western and East Coast joint cars. A later variation, to be seen in the newest Great Northern, North Eastern and Great Northern and North Eastern Joint restaurant-car "sets," is to have both kitchen and pantry in the third-class car. The whole first-class car is then available for the service of meals, while the provision of an open third-class car adjacent to the third-class kitchen car enables virtually as many third-class tables to be laid as may be desired. Such an arrangement allows of a great many meals being served at one time. In certain restaurant-car sets on the Midland and Great Eastern lines, as also in all those on the Lancashire and Yorkshire Railway, the practice is reversed, the kitchen and pantry being arranged in the first-class car, and the whole of an open third-class car being available for the service of meals. This allows for the service of a larger proportion of third-class meals to first-class, as compared with the first-mentioned arrangement.

The line which, on a great many of its trains, lays itself out to serve from one kitchen a larger body of passengers at one sitting than any other is the Great Eastern, a number of whose restaurant-car sets consist of three cars coupled together, a composite kitchen car in the centre being flanked on one side by an open first-class car, and on the other by an open third-class car. This practice may be traced to the fact that the restaurant car made its appearance on the Great Eastern Railway before the corridor trains, so that sufficient accommodation had to be provided in the cars to seat all the passengers requiring to breakfast or dine on the journey, there being no opportunity of changing into them *en route*. All these cars have, however, long since been fitted with end vestibules, and they form part of corridor trains, although in many cases it is still found convenient to run the sets of three cars together, as originally constructed, with their accommodation for the service of well over a hundred meals at one sitting. The kitchens of these vehicles have been greatly enlarged since they were first constructed. Indeed, the spaciousness of the culinary department is a matter in which the Great Eastern Railway may truly be said to excel. It is not surprising, in the circumstances, to find that company claiming a "record" in regard to the largest number of meals ever served at one time on a British train, namely, 226 breakfasts for a special party in two relays.

On the London and South Western line the accommodation of the single restaurant

Photo]. [*G. Marshall Smith.*

PULLMAN BUFFET CAR *Mayflower*:
Liverpool Street-Aylesbury Services, Metropolitan Railway.

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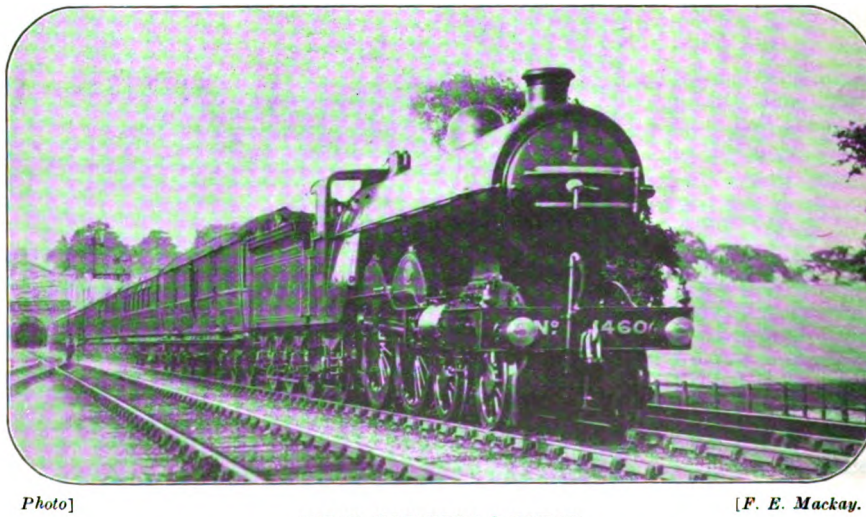
car always run is supplemented, when necessary, by the novel expedient of laying as many tables in the adjacent compartments as may be required. It may here also be remarked that the London and South Western Railway furnishes the one exception to the practice of managing the restaurant cars by the hotels department of the line, in that the catering is leased to the well-known firm of Messrs. Spiers and Pond, Ltd. On the Great Central Railway four trains only are provided with open cars for the service of *table d'hote* meals. They are the 10 a.m. and the 6.20 p.m. expresses from Marylebone to Bradford, and the corresponding return trains. *A la carte* catering is more the Great Central speciality. The majority of the trains are provided with a kitchen in one of the coaches, the meals being brought to the traveller in his own compartment; and, in view of the limited number of passengers conveyed, especially on cross-country services, this seems an eminently suitable plan. On the North British Railway somewhat similar arrangements prevail, the kitchen being arranged in the centre of a long twelve-wheeled compartment coach, in which tables are fixed. *Table d'hôte* meals are, however, served in most of the North British express trains. Some of the recent Great Eastern restaurant-car sets are also arranged on a novel plan, half the third-class coach being of an open type, and the remainder divided into three compartments, which are provided with tables and used for serving meals when necessary, but at other times are employed as ordinary compartments.

As previously mentioned, restaurant cars on the Great Western Railway are all run singly. Certain of them, having the kitchen in the centre, accommodate first-class passengers at one end and third-class at the other; but the majority have the kitchens arranged at one end, leaving the remainder of the car a large open compartment, in which both first and third-class passengers dine together, after the Continental fashion. A like plan is followed on the West of England services of the Midland Railway between Derby, Bristol and Bournemouth, The West Coast Joint cars, as well as a number of those in use on the London and North Western Railway, also run singly, and the novel spectacle may, therefore, be witnessed on certain trains, such as the 2 p.m. *ex*-Euston, of two cars, in different parts of the same train, with different destinations, each working independently of the other with separate *ménus* and each with its own *clientèle*. A number of the single London and North Western cars have the kitchen at one end, the first-class compartment in the centre, where the vibration is least, and the third-class compartment at the other end. Most of the different lines use single cars on certain less-extensively patronised services. For instance, the Great Eastern Railway employs the middle coach only of one of the three-car "sets" on the Southend branch, as being quite sufficient to meet the limited catering demands of that service.



Photo] [*F. E. Mackay.*

GREAT NORTHERN RAILWAY.

7.45 a.m. Restaurant Car Train *ex*-Edinburgh. Locomotive No. 1460 (Schmidt superheater class).

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EXTERIOR OF MIDLAND RAILWAY STATION, LEICESTER.

Notable Railway Stations and Their Traffic:

LEICESTER—MIDLAND RAILWAY.

By A. F. SHOULTS.

LEICESTER is provided with three stations, two of which are on main lines. The Great Central Company have some excellent north and south expresses, with a few local services in either direction; but the station is not, as yet, worked to its full capacity. In the case of the Great Northern Railway Leicester is only a branch line terminus, its services being chiefly slow passenger to such main line centres as Grantham and Peterboro'. But on the system of the Midland Company Leicester is one of the largest centres. It is also the first important commercial town on their route to Manchester or Leeds, and so has some of the best advantages with regard to quick services to and from London.

I divide the passenger traffic into eight separate sections :—

(A) *Midland.*

1. Main line south. To Bedford and London.
2. Main line north. (a) To Derby, Manchester and Liverpool. (b) To Nottingham (mostly slow passenger trains, Sheffield, Leeds, Carlisle and Scotland.
3. Birmingham branch, connecting with Bristol main line.
4. Burton branch. A second route to Derby.
5. Peterboro' branch. Also main line to Yarmouth and Norwich.
6. Rugby branch.

(B) *London and North Western Railway.*

7. Mostly local services between Leicester, Nuneaton, Leamington, Coventry, and Birmingham.

These various services apply at intervals throughout the day, and in addition several through carriages are transferred from one train to another daily, so that in the aggregate the Midland station is a busy centre for traffic of all kinds.

In view of the special interest of the

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traffic dealt with, or passing through, Leicester station, a detailed review of the train services throughout the day would be entirely in place; but it is thought preferable to confine attention to one period only, and for this purpose the six hours from from just before 4 o'clock in the afternoon until 10 p.m. are selected. Following remarks are based upon the train services in force during the summer months. During the remainder of the year some of the more interesting trains do not run, and others are altered; but on the whole the main features of traffic apply equally at all periods. Midland time-tables show a total of 73 arrivals or departures in the six hours mentioned. To them must be added two expresses, which pass Leicester at 7.51 p.m. and 8.40 p.m. respectively, and 10 local London and North Western Railway passenger trains. This makes the complete passenger train traffic 85, or an average of slightly over 14 trains per hour. This contribution is the result of an observance of the Midland passenger service, with special regard to the type of locomotive hauling the average loads of the trains; and the organisation of the local services when main line work is not quite smooth. Goods service is not included in the scope of the article. It is, therefore, to be understood that although in some cases telling of a single instance it is chiefly of a general nature, and the outcome not of one but of a series of visits to this station.

Leicester is a four-way station, consisting of two island platforms, for up and down roads. The platform section is controlled by two boxes, part of the buildings of either island platform, Leicester East and West. In each box are two complete locking frames. The four platforms are numbered, Nos. 1 and 2 being the down, and 3 and 4 the up platforms. The first express under notice is the 12.55 p.m. corridor express from Liverpool to London. A restaurant car is attached at Manchester, and a through coach from Buxton is included. Usually very heavy, averaging 300 tons, it is due in Leicester at 3.55 p.m. Five minutes are allowed for change of locomotive, and as this operation rarely takes that time, the express generally leaves punctually. Nearly always hauled from Leicester by a compound—although I have frequently seen it double-headed—it is not a fast-timed train, stopping at four places in the 99 miles to London from Leicester. Between 4 p.m. and 4.30 p.m. there are eight arrivals or departures, two of which are important main line expresses and one a London and North Western Railway passenger slow to Nuneaton.

All the platforms are in use during this half-hour, each, if the service runs smoothly, having two trains. The first arrival is at 4.5 p.m. This is an intermediate passenger direct from Northampton. The load is quite light—rarely 150 tons—and the locomotive generally a 2–4–0. Nearly all the Midland local services round Leicester are worked by these old locomotives. Their running is excellent, quite heavy trains being hauled at fast speeds on the short distance routes. At 4.15 p.m. one of the 1 hour 45 min. London-Leicester expresses arrives at Leicester. It is a Liverpool-bound train and has the through South Eastern and Chatham Railway carriage from Dover, Deal and Folkestone attached. Generally speaking, it has a heavy load, and is always hauled by a compound both to and from Leicester. After five minutes wait in Leicester, it departs at 4.20 p.m. for the north. But while the down main is thus occupied the other platforms are also busy. At 4.14 an express (Midland) leaves for Birmingham, hauled either by a single or 2–4–0; while at 4.18 p.m. the 2.40 p.m. from Sheffield draws up at No. 3 platform. It comes by the roundabout route of Chesterfield, Derby and Trent. The coaches are ordinary bogies, and the locomotive one of the smaller type of 4–4–0. Two minutes later an intermediate, which left Birmingham at 2.40 p.m., enters the down platform (No. 1), and five minutes afterwards two slow passenger trains—a Midland going north to Trent and Derby, and a London and North Western south to Nuneaton—leave simultaneously.

A word in passing about the London and North Western Railway locals. These are composed of six-wheeled stock, and hauled by the old double-end "tanks" of between 20 and 30 years ago. The junction with the Midland is at Wigston and the London and North Western Company's line from there to Nuneaton Junction forms the first part of the Midland Company's route from Leicester to Birmingham. Between Leicester and Nuneaton (London and North Western) the service is excellent in respect of the number of trains; but, owing to there being main line connections at either end, these branch slows are rather inclined to be late. It is stated, however, that they are not run as guaranteed connections. There are two bookings for 4.30 p.m. on the time-tables—

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a departure to and an arrival from Burton—both ordinaries, hauled by 2–4–0's or "singles," with light loads. The next train due is the first day Scotch express (9.30 a.m. *ex*-Edinburgh and 9.20 a.m. *ex*-Glasgow). Of the three day expresses this is the fastest-timed, performing the journey of 307¾ miles in 7 hours 2 min., or an average of nearly 44 miles per hour start to stop.

In summer this train is exceedingly heavy, and very often behind time from Carlisle southwards. A Compound hauls it from Leeds, although in times gone by it was managed by a much smaller locomotive; and I have travelled on it when only a 2–4–0 of the oldest pattern was its lot. But in spite of the heavy load, the locomotive kept good time, and on its journey from Leeds only lost two minutes. It waits in Leicester only three mintues, the usual change of engines being effected, and at 4.35 steams out on a non-stop run to St. Pancras, slipping a coach at Kettering. For an hour and a half after the departure of this south-bound Scotch express Leicester is free from main line expresses. Locals run as follows up to 6 o'clock:—

1. *Midland.*

Main line south: Arrivals, 5.40 p.m.; departures, 4.55 p.m.

Main line north: Arrivals, 5.15 p.m., 5.50 p.m.; departures, 5 p.m., 5.35 p.m.

Peterboro' branch: Arrivals, 4.44 p.m., 5.45 p.m.; departures, 4.40 p.m., 5.10 p.m.

Rugby branch: Arrivals, 4.40 p.m., 5.54 p.m.; departures, 5.20 p.m., 5.45 p.m.

Burton branch: Departure, 5.58 p.m.

Birmingham branch: 5.55 p.m.

2. *London and North Western.*

Local: Arrivals, 5.50 p.m.; departures, 5.13 p.m.

Through express Leamington-Nottingham, arrive 4.55 p.m.

This table totals up to 19 passenger trains in the hour and a half, or an average of a train every five minutes. The average is, however, misleading, as there is an interval of a quarter of an hour (5.20—5.35) during which no passenger traffic is organised from Leicester. The Rugby and Burton branch trains I pass over in only a few words. Their loads are light (rarely 150 tons), and the locomotives 2–4–0's or singles. On the Rugby branch alone have I seen a local hauled by a $\frac{0\text{–}4\text{–}4}{T}$ type. There is, however, some very smart work done in the sending off of these various slows, and in general they are never late. The 5.40 p.m. requires a few remarks. This is one of the trains

INTERIOR OF MIDLAND RAILWAY STATION, LEICESTER.

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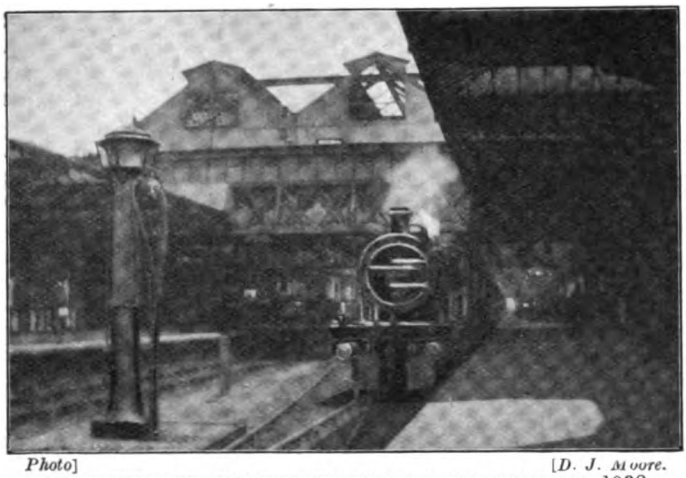

Photo] [*D. J. Moore.*

ANGLO-SCOTTISH EXPRESS COMPOUND LOCOMOTIVE NO. 1038
PASSING THROUGH LEICESTER STATION.

termed "slow-express" by the Midland Railway Company. Leaving St. Pancras at 2.50 p.m. it passes all stations to Luton and thence to Bedford and Kettering. It then becomes a stopping train calling at all stations to Leicester. Although the load is light it was on this train I first saw one of the new superheated 4–4–0s.

Of the main line south locals, too, nothing much can be said. I have described the running of the 5.40 p.m., and the 4.55 p.m. to Kettering does not call for special remark. It is composed of six-wheeled stock, unlike most main line intermediate trains, but is very light, and hauled, as usual, by a 2–4–0. The Peterboro' branch trains are also very similar. Their loads are somewhat heavier, and the smaller 4–4–0's are used quite as frequently as 2–4–0's or singles. The 4.40 p.m. is virtually an express, but it is booked to stop at most stations to pick up passengers for London expresses which travel by the Nottingham-Kettering loop. Both arrivals are just ordinary intermediate—one from Peterboro' and the other from Melton Mowbray only. The timetable shows four main line north trains, and it is about two of these that something must be said. In connection with these are included the 5.55 p.m. for Birmingham and the down London and North Western Railway Leamington-Nottingham express. The London and North Western Railway express is due to arrive in Leicester at 4.55 p.m. It consists of four or more London and North Western Railway corridor coaches, and, hauled from Leamington by a locomotive of the same company, is due out at 5 p.m., five minutes being allowed to change locomotives, etc. A Midland Company's engine hauls the train on to Nottingham, stopping on the way at Loughboro' only and omitting Trent Junction. The opposite through connection from Nottingham to Birmingham and Leamington likewise does not stop at Trent Junction, and arrives in Leicester at 5.50 p.m. This is a mixed train, consisting of both Midland and London and North Western coaches. Unlike the other, it is hauled both to and from Leicester by a Midland Railway locomotive, this in the latter case being always one of the large $\frac{0\text{–}6\text{–}4}{T}$ type. The addition of Midland coaches makes this a fairly heavy train, but the tank locomotive, quite equal to the task, carries its load with surprising ease. Indeed, along this Birmingham line several Midland expresses are hauled by these large tank locomotives.

Between the hours of 6 and 7 p.m. there are three important south-bound main line expresses and two north-bound, one of which may be termed a slow express. South-bound expresses leave Leicester at 6.10, 6.30 and 6.50 p.m., respectively. First and third are from Manchester, or, rather, the third, from Liverpool, connects with the first at Manchester, from which station it departs five minutes later, being altogether a slower train; the second is a Scotsman (10.30 a.m. *ex*-Edinburgh). The 6.10 p.m. leaves Manchester at 4.15 p.m., and Leicester is its first stop. Completed in 110 min., the journey of 91 miles gives the excellent average of just on 50 miles per hour. This express is also one of the fastest to London, performing the stage in 1 hour 45 min. From Manchester to London the average speed thus works out at 53 miles per hour. Not running on Saturdays, the train is usually heavy, and is hauled both to and from Leicester by compounds. The 6.50 p.m. *ex*-Leicester is almost exactly like the 4 p.m., the first express here mentioned. Its journey to London has four stops, as well as a conditional stop at Harpenden to put down passengers. The 6.30 p.m. is the slowest

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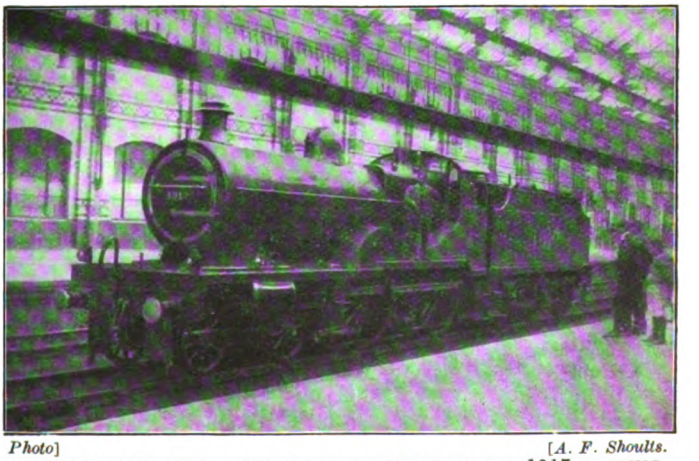
timed express from Edinburgh to Leicester. Although leaving only an hour later than the 9.30 a.m., it is two hours later arriving in Leicester. From Leicester it has a non-stop run to St. Pancras, arriving at 8.15 p.m.—another 1 hour 45 min. express.

On one of my visits to Leicester station there was a remarkable incident connected with this Scotch express and the 6.50 p.m. These two expresses are booked, the former to stop at Trent at 5.59 and leave at 6 o'clock, and the latter to pass the junction at 6.16 p.m. The Scotsman was about 20 min. late from Leeds, and as the Manchester was well on time, it was past Trent Junction first. Consequently the two trains were only about five minutes' journey from each other from Trent to Leicester; but the 6.47, arriving first, ran into the main line up platform, causing the Scotsman to use the up platform No. 4, perhaps for the first time. But, of course, the point under consideration was this: It would not do to despatch the 6.50 only five minutes ahead of the Scotsman, because, with its four stops, it would hinder the faster train. Consequently the 6.50 was kept waiting until after 7 o'clock while the Scotsman went on before. Both trains are heavy, and the 6.30 is hauled to and from Leicester by compounds, while the other, not being scheduled to run so fast, is hauled from Leicester by a 4–4–0 of the 500 class.

Two down expresses arrive at 6.10 and 6.25 p.m. respectively, the first being a "slow express" from London to Sheffield. It leaves St. Pancras at 3.40 p.m., and, besides the larger stations, such as Kettering and Wellingboro', stops at some smaller places, taking 2½ hours to do the 99 miles. The load varies from 200 tons to 300 tons, and the express is often double-headed to Leicester, but carried on by a compound from Leicester to Sheffield. The second north-bound train is the 4.30 p.m. *ex*-St. Pancras, Manchester and Liverpool express. This is a well-known train, although not one of the fastest timed, taking 1 hour 55 min. from St. Pancras to Leicester. It is an average train as far as load is concerned — about 250 tons — worked by the largest engines. There is on the train a through coach to Nottingham, transferred at Leicester on to the 6.35 p.m. local to Nottingham. There are only five local Midland and two London and North Western trains during this period. The first arrival is from Rugby, at 6.16, the usual 2–4–0 hauling. Next comes an express from Birmingham at 6.32 p.m., likewise hauled by a 2–4–0, while the third arrival, worked by the same type of locomotive, is from Burton, due in 6.37 p.m. The departing Midland locals leave at 6.40 and 6.55 p.m., the former being an intermediate to Melton Mowbray and Saxby, the latter a main line south slow to Bedford. This is, of course, following the 6.50 p.m. express, and is the connection for intermediate stations for passengers from Liverpool and Manchester.

There are 13 trains between 7 and 8 p.m. in Leicester. Of these one passes and one is an important south-bound express. There are three down expresses and nine locals. Before passing to the express trains I briefly mention the locals. From the Peterboro' branch there are two arrivals—at 7.5 p.m. and 7.15 p.m. The former is a through train from Peterboro' to Birmingham, and leaves Leicester at 7.32 p.m.; the latter, from Norwich and Yarmouth, has attached a through carriage for Burton, which is transferred at Liecester to the 7.35 p.m. departure to that town. There is also an arrival from Burton at 7.3 p.m. At 7.20 p.m. another direct Northampton-Leicester intermediate arrives, and at 7.23 p.m. comes a slow from Derby and Trent. Besides these are also the 7.54 p.m.



Photo] [*A. F. Shoults.*

LEICESTER STATION: COMPOUND LOCOMOTIVE NO. 1017 WAITING ON CENTRE ROAD IN TO TAKE ON 4.20 P.M. MANCHESTER EXPRESS.

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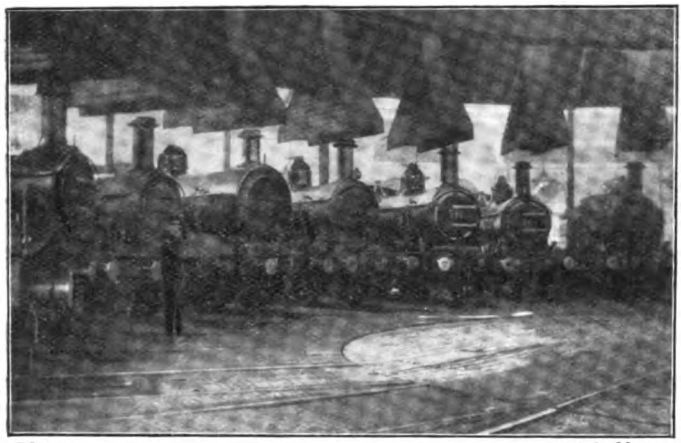

Photo] [D. J. Moore.

IN THE MIDLAND RUNNING SHED AT LEICESTER.

for Nottingham and 7.15 p.m. to Sileby. This last train is Saturdays excepted. There is also an express from Derby and Trent, arriving at 7.40 p.m., and a single London and North Western local from Nuneaton due in at 7.40 also.

I must now allude to the four main line expresses. The first, a down train (Saturdays excepted), leaves St. Pancras at 5.35 p.m., arriving in Leicester at 7.27 p.m., slipping a coach at Kettering. This is the return express like the 6.10 p.m. *ex*-Leicester, its only stop between London and Manchester being Leicester. Its average is, however, slower by three miles to the hour, since it takes 227 min. to perform the 190 miles' journey to Manchester. Yet the average speed from Leicester to Manchester is 53½ miles per hour start to stop, so that with the 1 hour 45 min. booking from London this would be the better train. To serve Derby and Loughboro' an express leaves Leicester for Manchester at 7.35 p.m., five minutes after the departure of the 5.35 p.m. *ex*-St. Pancras. Of average load, this train is usually hauled by a compound, and runs on Saturdays as well as other week-days. The next down express is due to pass Leicester at 7.51 p.m. This is the famous Heysham boat express, the 6 p.m. *ex*-St. Pancras. There can be no doubt as to its being well known, and certainly railway lovers will go a long way to see a finer sight than this express as it passes Leicester. Hauled always by a compound, and composed of some of the finest corridor stock in the country, it presents a magnificent sight. It is rarely late, and indeed five days out of the six passes Leicester rather before than after time.

I once witnessed a peculiar incident in regard to this express, and as the up Manchester-London train was involved I will speak of that first. This latter train is due in Leicester at 7.53 p.m., and unlike most other expresses, it does not change locomotives. I have travelled from Derby on the train when 3½ min. have been made up on that short journey of 29½ miles. I am afraid it was done chiefly by ignoring the speed restriction at Trent Junction, but, nevertheless, it was an excellent piece of locomotive work. This express is nearly always hauled by a 4-4-0 of the 700 class. On one occasion, for some reasons the 7.40 p.m express from Derby was left standing too long in the up main platform (No. 3). It will be noticed that the times of the boat train and the up express are only two minutes apart. It chanced that both trains were well on time—in fact, at Kettering the boat train was 2 min. to the good. This caused it to be signalled early into Leicester, while the other was signalled just on time. In a hurry the 7.40 p.m. was removed, and just as the shunting operations were in full swing, covering the down main line, the boat train arrived—one minute early. It was impossible to move the shunting 7.40, because of the arrival of the 7.53. Consequently, perhaps for the first time in its whole career, and certainly the only time to my knowledge, the Heysham boat express came to a stand in Leicester station. Not only that, but when at length the red changed to green five whole minutes had elapsed, and the 7.53 was departing for the south ere the Heysham express had drawn out of Leicester.

Between 8 and 9 p.m. the service is chiefly local. The tables, inclusive of London and North Western Railway trains, show a total of 14. There is but one London and North Western Railway departure for Nuneaton —at 8.5—and but one important express that stops at Leicester. No south-bound express halts here, but one passes—another day Scotsman. The rest are purely local service trains, and prove to be the following. An arrival from Rugby at 8.5 p.m., and a

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departure to Rugby at 8.11 p.m.; two arrivals from Birmingham, both intermediate which enter Leicester at 8.10 p.m. and 8.42 p.m., respectively. These two trains leave Birmingham by an hour's interval, the second being slightly faster and missing a few stations. There are two main line south locals which arrive at, and depart from, Leicester, at 8.20 and 8.50 p.m., respectively. The 8.20 is from Kettering and the 8.50 to that place. Main line north locals are three in number—two arrivals from Trent and Loughboro', and one departure to Nottingham to connect that town with the 6.30 p.m. *ex*-St. Pancras. On the Burton and Peterboro' branches there is one departure each, both at 8.45 p.m. The expresses are the 6.20 p.m. London-Manchester express already mentioned and the 1.30 p.m. *ex*-Glasgow. Of the former little need be said. The descriptions of other such expresses also serves in her case. Two hours all but three minutes are taken from London, there being one stop at Bedford. There is a three minutes' wait in Leicester, but no change of locomotive. The up express is due to pass Leicester at 8.40 p.m. It is a Trent-London non-stop train, but may have to break that run at Luton, being booked to stop in that town to set down any passengers from Glasgow. The load is light, and includes one Lancashire and Yorkshire coach —a through from Halifax to London. It is now hauled regularly by a new superheated locomotive of the 500 class. Unlike the Heysham boat express, it passes Leicester at a good speed.

Of one other express I desire to make mention. This train ceases to run after October 18, and is the Midland Company's Scotch sleeping car express. It leaves London at 7.10 p.m., and is booked through Leicester at 8.55 p.m.—a time which it invariably keeps—running *viâ* Derby to Leeds, and booked to stop at Rotherham to pick up passengers for Carlisle and beyond. The running from London to Derby averages 54 miles per hour, and throughout from London to Aberdeen 44 miles per hour average, or only 2 miles an hour less than the Great Northern Railway sleeping coach train, which travels at 46 miles per hour When it is considered that the Midland route is longer than the Great Northern by 13¾ miles, and much harder in gradients, one wonders what a Midland Railway locomotive would do on a Great Northern sleeping coach train.

From 9 to 10 p.m. the service in Leicester slackens considerably. On Saturdays there is no north-bound express, and on other week-days none until 10 p.m. Running south, however, is the fourth day, or, rather, afternoon, Scotsman. This express is the only one with a through connection to Leicester, coaches and restaurant cars being

Photo] [*D. J. Moore.*

UP EXPRESS COMPOUND LOCOMOTIVE NO. 1026 APPROACHING LEICESTER STATION.

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booked as such in the time-tables. Leaving Edinburgh at 2.15 p.m., and Leeds at 7.18 p.m., it reaches Leicester at 9.23, and to perform the journey takes 7 hours 8 min., or 6 min. slower than the 9.30 a.m. *ex*-Edinburgh previously mentioned. In load it is far lighter, being in winter composed of five bogie coaches and only one dining car. It is then frequently hauled from Leicester by a single. Yet with a booked stop to set down at Kettering, the journey is performed in 1 hour 48 min. Locals also are few. There are two from the Peterboro' branch, arriving at 9.10 and 9.40 p.m. The former is from Manton, while the latter comes from Peterboro'. Both are intermediate. At 9.33 p.m. a slow arrives from Burton, and at 9.25 p.m. another departs for Nottingham. There is but one other Midland from Kettering, which arrives at 9.45 p.m. The London and North Western Railway have three locals between these hours. One departs at 9 p.m., and another at 9.45 p.m., the latter missing one or two less important stations. If the 8.40 p.m. train is late it interferes with the London and North Western 9. p.m., booked to leave from the main line up platform (No. 3), through which the express, of course, runs. Several times remarkable work has been done in despatching this train. Often only three minutes are occupied to draw it up, fill, and despatch it. This is remarkable when it is remembered that a Burton train due out at 8.45 p.m. and a main line local at 8.50 p.m. are also kept for the express, and it means that three trains are despatched in three successive minutes.

MR. R. W. MAPP.
Stationmaster, Midland Railway Station, Leicester.

In conclusion I wish to mention the telegraph office of Leicester station. This is on No. 3 platform. Here the weather conditions are announced, together with the times of all arriving trains in Leicester at the various stations they pass where the telegraph office is in direct connection. South-bound trains may be followed from Sheffield, Rotherham, Chesterfield and Trent, or, on the Manchester route, Millers Dale, Derby and Trent Junction. North-bound from Bedford, Kettering and Wellingboro'. The branch lines are from each of their terminal (as far as regards Leicester) stations—Burton, Peterboro', Rugby or Birmingham. From 9.45 to 10 p.m. I wandered on the down main platform, knowing that the last train I had to observe was well on time; and, sure enough, just as both clocks pointed to 10, and I was turning my back on those well-known platforms, an immensely heavy express, hauled by a compound, drew slowly up into Leicester station.

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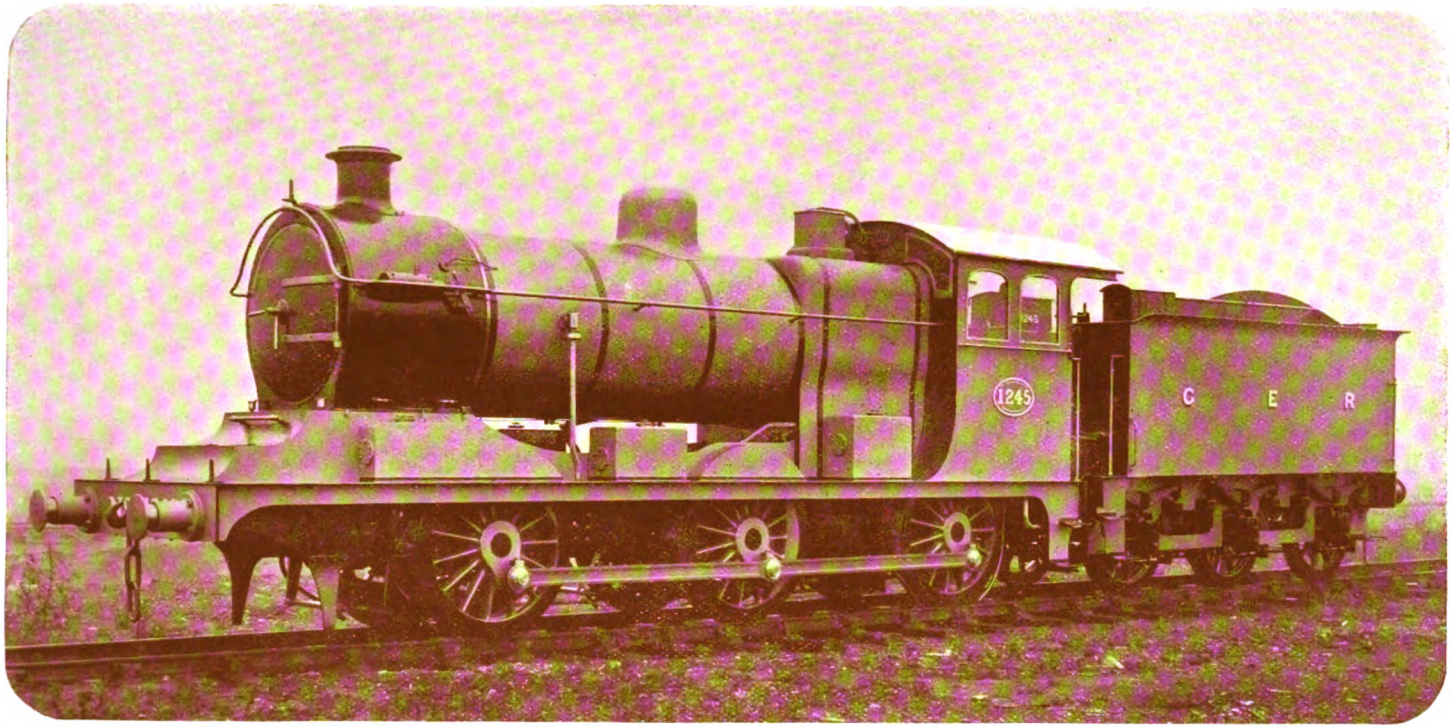

GREAT EASTERN RAILWAY: 6-WHEELS COUPLED GOODS LOCOMOTIVE, No 1245.

(Fitted with Schmidt Superheater.

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Photo] [F. E. Mackay.

LONDON AND NORTH WESTERN RAILWAY:
Edinburgh-London Express passing Tebay. Locomotives Nos. 2643 *Bacchus* and 561 *Antæus*.

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

AS foreshadowed in last month's article, it is my intention in the present issue to deal with London and North Western locomotive performance over the highly interesting stretch of line between Crewe and Carlisle. The runs described herewith extend over a considerable period, and one or two of them have appeared previously in these columns, but I have tabulated them all together in order to show clearly the behaviour of the different types of engines with as extensive a range of loads as possible. There is one particularly important point about these records to which I wish to draw attention, namely, that they include all the timings I have taken over this section of line within the last two or three years, and that no failures of locomotives to observe schedule times have been omitted from the table. Three appreciably late arrivals were recorded, but in each case the delays were due to causes beyond the driver's control, and on none of the runs, therefore, was there a single minute of lost time to be booked against the engine. This I consider a remarkable record, as on no single occasion did I have any preliminary conversation with drivers, so that every run could be classed entirely as ordinary performances. The outstanding feature of these fourteen runs—as will be apparent by the merest glance at the tables, particularly that dealing with the climbing to Shap summit—is the absolute triumph of superiority that the superheater engines have achieved over the types of engines previously in use, all being of the same general dimensions.

The fascination of the 141 miles separating Crewe and Carlisle—as a happy hunting ground for the compiler of "logs"—is centred in the fact that it includes every possible variety of gradient, over which locomotives may demonstrate their respective capabilities. From Carlisle to Warrington there is an easy course, mainly on falling grades, over which drivers can, if so minded, accomplish "even time" from the start. Between Wigan and Preston there intervenes a section of very broken "road," particularly beyond Wigan, the climb to Coppull summit being for some miles on either side decidedly steep. From Preston to Carnforth we have a level stretch of line, but from that point to Shap summit there is a rise of very nearly 900 ft., followed by a similar descent, only over flatter and more prolonged grades, into Carlisle. Again, a corresponding variety of

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loads are taken, ranging as high as 400 tons and over at busy times, which invest the hill-climbing work with a particular importance. Indeed, it is with the special object of calling attention to the remarkable uphill achievements of the superheater engines, as compared with the non-superheater variety, that I propose to devote the whole of the present article to this single subject. One may now witness on this route not only the haulage of really enormous unpiloted loads, considering the grading, but also the attainment of the ideal in express train working—the vast improvement of uphill speeds coupled with moderation in those on falling grades.

To render the tabular matter as intelligible as possible, I will first deal in somewhat closer detail with the grading roughly sketched out in the preceding paragraph. A level start from Crewe to Minshull Vernon is succeeded by undulating grades, mostly falling, but not steeper at any point than 1 in 330, very nearly to Preston Brook. Past the latter station there is a steeper fall at 1 in 180 for 1½ miles, while the approaches to the Manchester Ship Canal bridge, 1½ miles south of Warrington, are an upward incline of 1 in 135 for 1½ miles in each direction. Shortly after Warrington a rise of 5½ miles to Golborne begins, as steep at one point as 1 in 132, followed by a short stretch nearly level to Wigan. From that town there is a very steep climb to Coppull summit, commencing and finishing at 1 in 100, but with a short length at 1 in 330 between Standish and Coppull. The descent from Coppull to Preston is also steep, starting with 2 miles at 1 in 100, and having further lengths at the same inclination approaching Leyland and beyond Farington. Between these two points the line, indeed, falls about 220 ft. From Preston there is a rise of 1 in 500 for 3 miles, followed by the most level stretch of the whole journey—falling at 1 in 1060 and 640 to Brock, and then rising very slightly at 1 in 1060, with intervening strips of level, almost as far as Lancaster. A steep descent of 1¼ miles at 1 in 95 through the county town brings us to the Lune bridge, succeeded by an easier descent to the sea-shore at Hest bank—the lowest point touched on the journey. Continuing on the level, we pass Carnforth, and 1½ miles beyond ascend a 2¼-mile bank, of which 1½ miles are at 1 in 131. Descending again for 1½ miles at 1 in 280 and with a level stretch beyond we reach Milnthorpe, where the first portion of the main climb may be said to begin.

Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY:
Newspaper Express passing Tebay. Locomotives Nos. 1105 *Hercules* and 2081 *New Zealand* (Schmidt Superheater Class).

This first section, known generally as Grayrigg bank, as it attains the summit level at a wayside station of that name, 600 ft. above sea level, is 13 miles in length, without a single break. It starts with 2½ miles at 1 in 175 (Milnthorpe station is situate ½-mile north of the foot of the bank), and continues with single miles in succession at 1 in 103, 400, 109, 182, 105 and 120. Oxenholme station stands at the centre of the 1 in 182 mile. Further, there are 2½ miles at 1 in 133, and the final ascent is a 2-mile length at 1 in 100. A mile down at 1 in 200

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TABLE I. LONDON & NORTH WESTERN RAILWAY—CREWE TO CARLISLE.

Train ex-Euston.			10 A.M. (Glasgow Portion).											2 P.M.					6.40 P.M. ex-Preston.		
Type of Engine.			Non-Superheater.						Piloted non-s'her.	Superheater.					Piloted non-s'her.	Superheater					S'h't'r.
Distance (miles).	No. of run		Schedule times (mins.).	1 — City of London	2 1076 Prince of Wales	3 1534 Westmorl'nd	4 1020 Majestic	5 565 City of Carlisle	6 887 Fortuna	7 ¶830 Phosphorus	8 1721 Defiance	9 1452 Bonaventure	10 2155 W. C. Brocklehurst	Distance (miles).	Schedule times (mins.).	11 †353 Britannic	12 819 Pr'e of Wales	13 2663 George the 5th	Distance (miles).	Schedule times (mins.).	14 2498 Cyprus
	Engine No.																				
	,, Name																				
	,, type			4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-4-0			4-6-0	4-6-0	4-4-0			4-4-0
	Total load (axles)			30	30	30	42	42	44	48	38	46	48			‖46	‖46	‡48			§44
	,, ,, (tons)			205	205	205	285	285	310	330	270	325	340			‖330	‖330	‡340			§305
—	Crewe	dep.	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	—	0	0.00	0.00	0.00	—	—	—
5	Minshull Vernon	pass	—	8.30	8.15	7.45	7.20	7.25	7.55	7.50	8.35	7.30	8.00	5	—	8.40	8.15	8.40	—	—	—
											g	g	g								
11¾	Hartford	,,	—	15.30	14.50	14.15	13.50	13.35	14.00	14.35	16.25	14.25	15.20	11¾	—	16.00	14.45	15.35	—	—	—
19	Preston Brook	,,	—	22.15	21.20	20.45	20.05	19.45	19.55	21.15	23.15	20.40	22.15	19	—	22.45	22.00	22.25	—	—	—
24¼	Warrington	,,	27	27.00	26.20	25.35	24.35	24.30	24.20	26.05	28.15	25.10	27.05	24¼	26	28.05	27.10	27.30	—	—	—
					b																
31¼	Golborne	,,	—	34.00	37.50	32.45	32.05	31.45	31.10	33.05	36.20	32.25	34.45	31¼	—	35.50	35.10	36.00	—	—	—
										f											
36	Wigan	,,	40	39.05	43.10	38.15	37.10	37.05	36.00	39.40	41.00	37.10	39.30	36	40	41.20	40.30	41.40	—	—	—
											h										
41¾	Coppull	,,	—	46.20	50.40	46.10	45.05	44.55	43.10	47.45	49.45	44.25	46.40	41¾	—	50.20	49.00	49.50	—	—	—
				a																	
51	Preston††	,,	58	57.05	59.55	55.15	54.00	54.45	52.05	57.50	59.30	53.55	56.05	51	59	60.00	59.20	59.55	—	0	0.00
55¾	Barton	,,	—	64.20	66.40	61.45	61.15	61.30	58.50	64.35	66.05	61.15	63.15	4¾	—	8.15	8.05	8.40	4¾	—	8.05
63¾	Scorton	,,	—	72.05	74.25	70.00	69.25	69.25	66.15	72.10	73.55	69.00	71.00	12¾	—	16.20	15.45	16.20	12¾	—	15.25
72	Lancaster	,,	81	79.50	82.15	78.40	77.45	77.35	74.10	80.10	82.00	76.55	79.00	21	23	24.20	23.25	24.00	21	23	23.05
					c																
78¼	Carnforth	,,	88	85.10	91.10	84.15	83.30	83.05	79.50	85.45	88.00	82.50	84.30	27¼	30	30.10	29.00	29.15	27¼	31	29.10
85½	Milnthorpe	,,	—	92.40	99.40	92.00	91.05	91.00	88.00	93.15	95.20	90.15	91.40	34½	—	38.25	36.25	36.15	7¼	—	10.05
								d													
91⅛	Oxenholme	,,	101	99.10	106.15	98.45	98.25	99.35	95.25	99.45	101.20	97.20	98.50	40⅛	44	*45.15	43.10	42.35	12⅞	17	16.35
98½	Grayrigg	,,	—	109.40	117.15	109.45	111.25	111.50	108.35	110.25	110.35	111.00	110.35	47⅛	—	57.30	54.40	53.40	7	—	12.45
104½	Tebay	,,	117	115.55	123.40	116.15	118.25	118.40	115.25	116.50	117.05	117.50	117.00	53⅛	62	64.15	61.05	60.20	13	1	19.10
109¾	Shap Summit	,,	127	125.00	133.10	126.15	128.35	129.40	126.45	126.25	125.15	127.10	125.35	58¾	72	74.00	69.30	70.20	18⅝	2	28.20
111¾	Shap	,,	—	127.25	135.50	129.05	131.30	132.30	129.30	128.55	127.55	129.50	128.30	60¾	—	76.45	72.15	72.55	20⅝	—	30.05
123¼	Penrith	,,	141	138.05	146.20	139.40	141.10	143.05	139.50	140.10	140.15	140.50	138.45	72¼	86	87.00	83.35	84.10	32⅛	43	43.10
130⅝	Calthwaite	,,	—	145.05	153.00	145.55	147.55	150.35	146.45	148.00	147.15	147.30	145.10	79⅜	—	94.05	90.20	90.45	—	—	—
136¼	Wreay	,,	—	150.00	157.50	150.50	152.55	155.30	151.40	153.35	153.05	152.30	149.50	85¼	—	98.50	95.05	95.45	—	—	—
								e			k					k	k	e			
141	Carlisle	arr.	159	155.00	162.45	155.50	158.10	162.35	156.45	159.25	159.35	157.40	155.10	90	104	105.05	101.45	103.30	—	—	—
141	Net times (mins.)		159	154	155	155¾	158¼	159¼	156¾	158	155	156¾	154	9 0	104	‡‡103¾	100	100¾	—	—	—

Thick horizontal line indicates booked stop.

¶ Pilot throughout 2–4–0 type. † 2–4–0 type pilot Oxenholme to Carlisle. ‖ Load to Preston, 56 axles (400 tons). ‡ Load to Preston, 58 axles (410 tons). § Load to Carnforth, 51 axles (350 tons). †† Severe service slack on all runs. * Stopped at Oxenholme to attach pilot. Duration of stop is deducted from times beyond. ‡‡ No deduction made for time lost stopping at and starting from Oxenholme. *a* Permanent way check, Euxton. *b* Severe permanent way check, Golborne. *c* Severe permanent way check, Hest Bank. *d* Permanent way check, Milnthorpe Junction. *e* Dead stand for signals, Upperby Bridge Junction. *f* Signal check, Bamfurlong. *g* Permanent way check, Winsford. *h* Permanent way check, Boar's Head. *k* Signal check, Upperby Bridge Junction.

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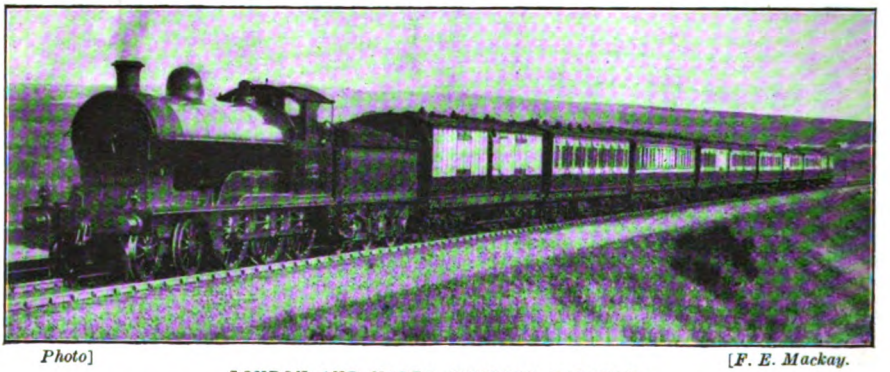
is followed by an undulating stretch to just before Tebay, where the last and much more severe section of the climb—Shap incline proper—is encountered. The initial grade is 1½ miles at 1 in 147, Tebay Junction standing 1 mile from its foot, and then, as a concluding task, there are exactly 4 miles inclined at 1 in 75, leading to Shap summit, 915 ft. above sea level. The whole climb is, therefore, encompassed within a distance of 24½ miles, barely 4 miles of which are not on ascending grades. Beyond the summit a more extended fall, at somewhat easier grades, is experienced. There is a mile of level track at the summit, followed by 3¼ miles down at grades varying from 1 in 100 to 1 in 150. A mile and a half beyond Shap station (2 miles north of the summit proper) begins an unbroken fall at 1 in 125 for 6¼ miles; but the next 9½ miles past Penrith, although mainly falling, are broken with sections of level track. The steeepst of the inclines on this division are a mile at 1 in 182 between Clifton and Penrith and 1½ miles at 1 in 184 between Penrith and Calthwaite. One mile south of Calthwaite the final descent opens with 2½ miles at 1 in 169, continuing with 3 at 1 in 229, 1¼ at 1 in 188 (concluding at Wreay), 1 at 1 in 140, and finally 3½ at 1 in 132, with a level ½-mile into the Citadel station. The total drop from Shap summit to Carlisle is about 850 ft.

A word may here be added about the speed restrictions. The only really serious slack is that through Preston, which, occurring at the foot of down grades in each direction, is somewhat of a handicap to heavy trains. There are, however, several other points where cautious drivers generally moderate their speed, either by shutting off steam or actually applying the brake. These are Weaver Junction, where the Liverpool main line diverges, Warrington and Wigan stations, Euxton Junction (with the Lancashire and Yorkshire Railway, 5 miles south of Preston), and recently, also, the winding approach to Lancaster. As every one of these points is situate either in the middle or at the foot of a down gradient, the reduction, as it was made from high speed, in such cases adversely affected the total time, although, for obvious reasons, I do not call attention to the cases in which speed was, and those in which it was not, materially reduced. Excessive speeds are not encouraged north of Shap summit, owing to the winding character of the descent, and drivers are also expected to moderate their speed through Penrith station. Some of the runs, in fact, will be seen to have suffered on this concluding stretch owing to the excessive caution displayed by drivers over the falling grades. Beyond stating the bald fact that the maximum speeds I recorded were 86·5 miles per hour down the 1 in 125 (with an "Experiment") and 80·3 miles per hour down the final incline into Carlisle (with a superheater 4–4–0), I do not intend to mention the maximum speeds attained on the descent from Shap summit, it being sufficient to state that in most cases they were far below what could have been achieved. A general idea of the way in which drivers both observed the slacks mentioned, and also descended the long incline, can be obtained by a close study of the table.



Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY:
Perth Express ascending Shap. Locomotive No. 1553 *Faraday.*

The first ten runs were made on the Glasgow portion of the 10 a.m. express *ex*-Euston, which has the fastest booking in force, covering the 141 miles from Crewe to Carlisle non-stop in 159 min. (winter timing) at an average speed of 53·2 miles per hour. Of these ten the first three were with 4–6–0 "Experiment" type engines with moderate

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loads; the next three with the same type, but substantially heavier trains; and the seventh with an "Experiment" piloted throughout to Carlisle. Nos. 8 and 9 are runs behind unpiloted 4–6–0 superheater engines of the "Prince of Wales" type, and No. 10 behind a superheater 4–4–0 of the "George the Fifth" class. Next we have three runs with the 2 p.m. *ex*-Euston—a heavy train which usually loads to 56 or 58 axles from Crewe, and 46 or 48 from Preston. The timing for the 51 miles from Crewe to Preston is 59 min., averaging 51·9 miles per hour, and that for the 90 miles thence to Carlisle 104 min., also giving an average of 51·9 miles per hour. It will be seen that the 4–6–0 "Experiment," whose run is given in column 11, required (as was customary) to stop at Oxenholme in order to take a 2–4–0 pilot over the summit to Carlisle, whereas the 4–6–0 and 4–4–0 superheaters, in columns 12 and 13, dispensed with any such assistance. Indeed, piloting in each direction between Carlisle and Oxenholme seems a thing of the past, now that superheater engines have been introduced; and loads exceeding 50 axles are frequently hauled unaided over the summit. The biggest loads I have yet seen superheater-hauled have been 54 axles on the down journey and 56 on the up, although I have not been sufficiently fortunate to secure a record in any similar case. Neither am I aware whether these figures represent the maximum loads allowed, although, considering the gradients to be surmounted, they are certainly surprising enough. The last run (No. 14) was a special effort to which I shall later make reference.

In the first place, some general points may be noted. The working time-table, after the general custom of these compilations, errs on the side of undue severity as regards the Carnforth-Shap times. An allowance of only 13 min. for the 12⅞ miles from Carnforth to Oxenholme, as is the case with the 10 a.m. down, is really impossible, seeing that it includes no less than 8¼ miles up, at grades varying from 1 in 103 to 1 in 182. No driver could observe it, and only one engine—a superheater 4–4–0, in run No. 10—was able to get within measurable distance of the time. The 2 p.m. down is allowed 14 min., and in this case one of the superheater 4–4–0 engines—run No. 13—managed with 340 tons, to make the same time of 13 min. 20 sec., which was an exceedingly fine performance. An allowance of 16 min. for the 13 miles from Oxenholme to Tebay—including as they do more than 9 miles uphill, ranging mainly from 1 in 100 to 1 in 147, and entered upon at a low rate of speed—is almost equally impossible; and here again only the one superheater 4–4–0 engine achieved the task, finishing with 15 sec. in hand. The 2 p.m. *ex*-Euston is allowed 18 min. for the same distance, and in this instance both superheater engines kept booked time without difficulty, despite their heavy loads. A more reasonable allowance is that of 10 min. for the 5⅝ miles from Tebay to Shap summit, and this was accomplished without difficulty on all the runs but three. The worst loss of time, however, is that generally experienced between Carnforth and Tebay, amounting in one case to as much as 4½ min.

In these circumstances, it was not surprising to find drivers amassing what they could of spare time south of Carnforth, prior to entering upon the climb, where the schedule times are far easier. Although, of course, the possibility of such variations on schedule time is more or less dependent on the particular relation of the grading and the booking—that is to say, on whether the easy booking precedes or succeeds the difficult schedule—to my mind a gain on schedule time, in view of not thrashing an engine uphill on a subsequent stage, is far preferable to losing time at the opening of a run with the idea of regaining it later on in the journey. In the latter instance, dislocation of traffic over a crowded section of line is almost inevitable. In the former, however, the driver, by running before time, is taking the risk of being "held up" if necessary to avoid such dislocation, after which delay he is still likely to have remaining at least the schedule time in which to complete his journey. The times past Carnforth furnish some diverting reading, the modest economy on schedule in run No. 7 amounting to 8 min. 10 sec. with the obvious corollary that the climb from Carnforth to Shap was the slowest of the series. In fact, every single train was either "on time" or substantially in front of it at Carnforth, except No. 2, which had experienced two serious delays, one occurring immediately before passing the latter town. It is also worth noticing that only on this run, on No. 5, where a delay was experienced at the foot of Grayrigg bank, and on No. 4, were the trains late past Shap summit. A considerable variety in the times past Carnforth was levelled up in a surprising fashion on the climb, showing that the drivers of those engines which made the slowest ascents probably had something in

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hand, but did not thrash their "steeds," as there was no occasion to do so. The close correspondence of three of the superheater times (Nos. 8, 9 and 10) at Grayrigg and Tebay in particular is very curious.

In the case of the 2 p.m. down, the Preston stop rather alters this state of affairs. There is obviously no reason for gaining time to this point, seeing that the train must wait at Preston until its schedule time of departure. Neither is there much opportunity of doing so between the time of leaving Preston, and reaching the foot of the long bank. The time allowed from Carnforth up to Tebay, as already mentioned, is, however, longer by 3 min. than that given to the 10 a.m. down, and so is observed by the superheater engines with comparative ease, despite the weight of this train. I spoke of there being no object in gaining time south of Preston, but, truth to tell, there would be no possibility of doing so even if it were desirable, seeing that the time allowed to Preston stop is only 1 min. more than that to passing Preston, in the case of the 10 a.m. down, whereas the normal load is one of 58 axles, or well over 400 tons. It will be noticed that on all three runs with the 2 p.m. down time was lost to Preston in varying degrees, although in no case by more than a minute.

The principal matter to which I desire to draw attention in this article is the actual work performed between Carnforth and Shap summit. This is set forth in detail in the second table, and is, I venture to say, in certain of the superheater locomotive runs, unsurpassed on any line in the British Isles employing engines of roughly similar dimensions. Partisan readers will note that my remark is purely speculative, but my speculation is based on the fact that during many thousand miles of travel I have never secured records of a series of runs such as these displaying finer or more consistent uphill work. The general characteristics of each run were that Carnforth was passed at a speed of from 70 to 75 miles per hour, and that on the short Burton ascent a minimum of about 54 miles per hour was followed by a maximum of from 60 to 67 miles per hour to Milnthorpe. Then ensued the 13-mile climb to Grayrigg, after which, with practically every train, a speed ranging from 60 to as much as 68 miles per hour was touched before passing Tebay. The final ascent to Shap summit furnished the culminating feature of each run. It was not so much on the actual minimum speed on each climb that its particular merit depended, seeing that small factors, such as premature notching up near the summit, and especially slipping, considerably affecting the actual figure on one or two occasions. Consequently I attach more importance to the total time taken on each

Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY:
10 a.m. London-Edinburgh Express ascending Shap. Locomotive No. 2021, *Wolverine*
(Schmidt Superheater Class).

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TABLE II. LONDON & NORTH WESTERN RAILWAY—CARNFORTH TO SHAP SUMMIT.

Point to Point Distances (mls)	Type of Engine.	Non-superheater.						Piloted non-s'her		Superheater.				
	No. of Run	1	2	3	4	5	6	7	11	8	14	9	12	10	13
	Type of Engine	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-4-0	4-6-0	4-6-0	4-4-0	4-4-0
	Load (tons)	205	205	205	285	285	310	330	330	270	305	325	330	340	340
7¼	Carnforth to Milnthorpe	7.30	‖8.30	7.45	7.35	7.55	8.10	7.30	8.15	7.20	‡10.05	7.25	7.25	7.10	7.00
5⅝	Milnthorpe to Oxenholme	6.30	6.45	6.45	7.20	†8.35	7.25	6.30	*6.50	6.00	*6.30	7.05	6.45	7.10	6.20
7	Oxenholme to Grayrigg	10.30	11.00	11.00	13.00	12.15	13.10	10.40	*12.15	9.15	*12.45	¶13.40	11.30	11.45	11.05
6	Grayrigg to Tebay	6.15	6.25	6.30	7.00	6.50	6.50	6.25	6.45	6.30	6.25	6.50	6.25	6.25	6.40
5⅝	Tebay to Shap Summit	9.05	9.30	10.00	10.10	11.00	11.20	9.35	9.45	8.10	9.10	9.20	8.25	¶8.35	10.00
31½	Total	39.50	‖42.10	42.00	45.05	†46.35	46.55	40.40	*43.50	37.15	†44.55	¶44.20	40.30	¶40.55	41.05
	Minimum speed, Grayrigg (miles per hour)	37.8	34.6	34.6	30.6	31.3	30.1	37.5	38.0	39.5	37.5	¶27.4	36.0	33.3	32.8
	Minimum speed, Shap St (miles per hour)	27.0	25.5	24.1	23.5	21.2	21.7	27.3	27.9	29.9	26.6	24.9	28.5	¶22.5	22.5

‖ Severe check just before Carnforth.
† Check at Milnthorpe Junction.

* Times to and from dead stop at Oxenholme.
‡ Time from start at Carnforth.
¶ Low minimum speed due to slipping near summit of bank.

climb from the foot to the summit, that is, from Milnthorpe to Grayrigg and from Tebay to Shap summit respectively.

On both climbs the superheater 4–6–0 *Defiance*, whose run appears in column 8, literally bade defiance to all competitors, and gave an extraordinary display. The minimum speed of 39·5 miles per hour on the final 1 in 100 of Grayrigg bank, and of 29·9 on the 1 in 75 of Shap were both startling achievements with 275 tons, although it was a trifle disappointing to fall short of 40 and 30 respectively by such very small margins. Of the other superheater times from Milnthorpe to Grayrigg, that of *George the Fifth*, in column 13, was phenomenal, seeing that the load was 340 tons. It excels the times of every run in the series, save those of *Defiance* just mentioned, of the "Experiment" in column 1 with a very light train, and of the "Experiment" in column 7, which required to take a pilot for a load a trifle less in weight. The minimum speed on Grayrigg bank in all these three cases was, curiously enough, 37·5 miles per hour. Even the work of *W. C. Brocklehurst* and *Prince of Wales*, in columns 10 and 12, was superior to that of the three unpiloted "Experiments" (columns 4, 5 and 6), which were hauling very considerably smaller loads. The only disappointment was *Bonaventure's* ascent, shown in column 9; but on this occasion the engine slipped rather badly near the summit of the bank, owing to accumulations on the track of wet leaves, which made the rails very greasy. Time was also well in hand, while an excellent ascent of Shap incline showed that the engine had by no means exhausted her powers on Grayrigg bank. The unpiloted "Experiments" in runs 1, 2 and 3 all performed good work with light loads, as also did the combination of "Experiment" and "Jumbo" in run 7.

From Tebay to Shap summit the honours rest in a still more marked degree with the superheater engines, *Defiance*, *W. C. Brocklehurst* and *Prince of Wales* (columns 8, 10 and 12 respectively) holding a very substantial lead over all competitors. *W. C. Brocklehurst* would probably have achieved a record time, the speed having only fallen to 30 miles per hour at a point quite near the summit when she became a prey to rather violent slipping on a wet rail. This reduced the minimum speed to 22·5 miles per hour, and adversely affected the total time, although even that, with 340 tons behind the tender, was noteworthy enough. Another remarkably fine effort was that of *Prince of Wales*, with a

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minimum speed as high as 28·5 miles per hour at Shap summit. *Bonaventure* made brave amends up Shap incline for her inferior performance up Grayrigg bank, beating all the "Experiment" times save that shown in the 1st column. *George the Fifth*, curiously enough, did not do so well as up to Grayrigg, although even yet she—or, to be more accurate, "he"—kept the booking easily and eclipsed the times of the three "Experiment" runs (columns 4, 5 and 6), when considerably lighter loads were hauled. The best "Experiment" climb to Shap summit was that of *Majestic* (column 4), whose 10 min. 10 sec. is very creditable for a non-superheater engine with as much as 285 tons behind the tender. Good work was also done by the engines in the first three columns, but in these three cases the loads were much lighter. The same remark might be applied to the performance of the piloted *Phosphorus* in column 7.

The net results of these efforts are best expressed in the total times taken by each train from Carnforth to Shap summit. *Bonaventure* achieved a really remarkable feat by covering this 31½ miles, which includes a vertical ascent of nearly 900 ft., in 37¼ min., at an average speed throughout of no less than 50·7 miles per hour. This was the only engine to keep the 10 a.m. booking, gaining 1¾ min. in addition, with a total load of 270 tons. Second place falls to the non-superheater *City of London* (column 1), whose load was, however, a mere trifle of 205 tons. In my opinion the real honours rest with *Prince of Wales*, *W. C. Brocklehurst*, and *George the Fifth*, whose times of 40½ min., 40 min. 55 sec., and 41 min. 5 sec., with loads of 330, 340 and 340 tons respectively, constitute about the most phenomenal feat of hill-climbing that it has ever been my privilege to record. Not only so, but they actually beat those of every unpiloted non-superheater run except that of *City of London* just mentioned, with a load little more than half as heavy, at the same time equalling the performance of the piloted "Experiment" in column 7 with an almost identical load. *Bonaventure's* total time suffers from the poor ascent to Grayrigg, although even then superior to that of the three "Experiments" in columns 4, 5 and 6, which hauled considerably lighter loads. If my recent correspondent, who expressed some scepticism as to the advantages to be derived from the use of superheated steam, cannot be convinced by the unassailable testimony of these runs—which to my mind simply put the argument for the non-superheater engines out of court—his case must, I fear, be regarded as hopeless.

And now as to the runs generally. The first tabulated, behind *City of London*—whose number unfortunately I omitted to insert in the record—was among the best of the "Experiment" efforts, although the load was light. Schedule times were fairly closely observed throughout, but the particular virtue of the run was the magnificent ascent to Shap summit, only 50 sec. being lost on the severe booking from Carnforth to the summit box. Consequently the latter point was passed earlier than on any other run, 2 min. before time. With a smart descent to Carlisle the total time for the journey was also the fastest of the series, 4 min. having been gained on schedule time. A curious point in connection with the second run was that the non-superheater "Experiment" hauling the train bore the same name as is now carried by the pioneer of the superheater 4–6–0 engines, whose run appears in column 12. Presumably the name of the former engine has since undergone an alteration. Two very serious checks were experienced on this journey, both at important strategic points. The first occurred at the foot of the ascent to Golborne, and the second just beyond Lancaster, where speed usually rules very high, giving trains an impetus to surmount the short rise beyond Carnforth. It is, however, worthy of note that on this occasion, although we passed Carnforth very slowly, only 35 sec. were lost on the tight timing from that point forward to Carlisle. Thus the run was really but little inferior to the one preceding, although the gross time occupied showed a loss of 3¾ min. The third run, also with a light train, was almost equally good, although possessing no features of special note.

With loads heavier by roughly 50 per cent., the next series of three "Experiment" runs exhibited the characteristic mentioned earlier of gaining time out to Carnforth in order to surmount the long banks without assistance and without excessive arrears of time. The three times out to Warrington were particularly noteworthy, being in each instance within a fraction of "even time." On runs Nos. 3 and 4 *Majestic* and *City of Carlisle* started in really remarkable fashion to Minshull Vernon, covering this 5 miles from the start in 7 min. 20 sec. and 7 min. 25 sec. in each case with loads of 285 tons. Both these runs continued well, the two engines having 4½ and 5 min. in hand

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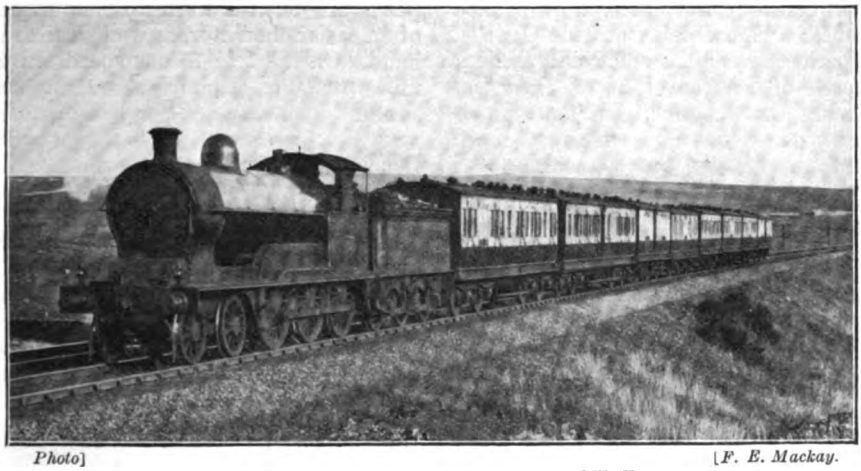
respectively at Carnforth; and on the first *Majestic*, despite a somewhat slow ascent to Shap summit, achieved a punctual arrival by means of smart running into Carlisle. *City of Carlisle*, however, experienced a bad check at Milnthorpe Junction, where new permanent way was being laid, and the ascent of Grayrigg bank was thereby adversely affected, while a comparatively slow descent of the long incline to Carlisle, with a signal check at the conclusion, resulted in an arrival late by 3½ min.

By far the best "Experiment" run of the series was, however, that of *Fortuna* (column 6), which was in certain respects extraordinary, particularly in respect of the start. Our time through Warrington was the fastest of all, a top speed of 77·5 miles per hour having been attained at Preston Brook. By Golborne "even time" had been more than attained, and the times to Wigan, Preston, Lancaster and Carnforth were all in the nature of genuine "records." In fact, a close study of the table reveals the astonishing fact that, of all these runs, the Crewe-Warrington, Warrington-Wigan, Wigan-Preston, and Preston-Lancaster times were faster than those of all competitors. To cover the 78¼ miles from Crewe to Carnforth in 79 min. 50 sec. was, it will be seen, a clear 3 min. ahead of the time on any competing run, and the economy of 8 min. 10 sec. on booked time to this point was itself, I should imagine, in the nature of a "small record" in the case of a first-class express of this character over so comparatively short a distance. In these circumstances, the driver had fully earned the privilege, which could not be gainsaid him, of making the slowest time of the series from Carnforth up to Shap summit, which point, with an expert calculation of effort required, he passed almost exactly to booked time. A smart descent to Carlisle yielded an arrival early by 2¼ min. I have always considered this as the finest run I ever made behind an "Experiment," as the climbing on the earlier part of the journey, such as Warrington-Golborne, and Wigan-Coppull showed clearly what could, if necessary, have been done up to Shap summit, while the 67 miles per hour maintained without difficulty on the level stretch between Preston and Lancaster was similarly a remarkable tribute to the powers of the engine. The run in column 7 loses some of its merit in that it was piloted. In proportion to the engines, the load ranks with those of the first three runs, and the performance was very similar. Had not the running from Shap summit been unnecessarily cautious, we should have arrived well before time.



Photo] [F. E. Mackay.

LONDON AND NORTH WESTERN RAILWAY:
Preston-Carlisle Express ascending Shap. Locomotive No. 1703 *Northumberland*.

I have already dealt with the virtues of the superheater runs, as disclosed principally in the smartness of the climbing. Without exception the drivers of the superheater engines observed with scrupulous care the points of cautious running mentioned, so that the earlier parts of these runs, except in the case of No. 9, appear slower than the corresponding parts of those which preceded them. *Bonaventure*, however, ran rather hard as far as Carnforth (the top speed was one of 77·5 miles per hour past Preston Brook), passing Carnforth more than 3 min. before time with a view to an easy ascent to Shap. Despite slipping on Grayrigg bank, the

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ascent of Shap incline was so much better as to take us on time past the summit box. *Defiance*, which throughout from Carlisle had adhered closer to schedule times than any other engine, ran with unnecessary caution down into Carlisle, and with a slack at the finish of the run arrived a fraction behind time. The best of all the runs on the 10 a.m. down was, however, that of *W. C. Brocklehurst* (column 10) which was really magnificent throughout with so heavy a train, its special feature again being the climbing of the long incline.

On the 2 p.m. down *Britannic* (column 11) did excellently, especially from Preston to Carnforth, but had to stop at Oxenholme for pilot assistance. The uphill work of the two engines from the dead stand was so good that we should certainly have arrived on booked time but for a signal delay outside Carlisle. Both superheater engines achieved excellent work north of Preston, that of *Prince of Wales* being the superior. In fact, a net average speed of 54 miles per hour from Preston to Carlisle in the latter case was really wonderful with a load of 330 tons behind the tender. There was but little to choose between the work of *W. C. Brocklehurst*, *Prince of Wales* and *George the Fifth*. The introduction of these superheater engines may truly be said to mark the beginning of a fresh epoch in London and North Western locomotive performance, their work being so immeasurably superior in every respect to that of the non-superheater locomotives.

In certain respects I am inclined to place the last run of the series, No. 14, almost above the whole of those tabulated as to merit. Possessing as it does so many features of note, I will describe it at greater length. The start of *Prince of Wales* from Preston to Barton was equalled with a load 20 tons heavier, and a maximum speed of 67 miles per hour was attained at Brock troughs, after which *Cyprus* actually maintained an unvarying speed of 66·2 miles per hour up the slightly adverse grades to Garstang. A maximum speed of 71·4 miles per hour beyond Lancaster brought us into Carnforth in nearly 2 min. under the sharp 31 min. booking. The next schedule, even though with a reduced load of 305 tons, I expected to find impossible of observance, as it includes a total of 8¼ miles uphill, varying principally from 1 in 103 to 1 in 182. Yet up the initial 1 in 131 from the start the driver managed to attain a speed of about 40·6 miles per hour.

On the slight down grade beyond we touched 63·7 miles per hour, and so stopped triumphantly in Oxenholme station in 25 sec. under the tight allowance of 17 min. From Oxenholme the start was really extraordinary. Starting on the 1 in 182, and up the succeeding grades of 1 in 105, 120 and 133, *Cyprus* with 305 tons actually accelerated to 42·4 miles per hour, although dropping back on the final 1 in 100 to a minimum of 37·5 miles per hour. On the level from Grayrigg to Tebay we attained the highest speed of the series—68·1 miles per hour—but the work up Shap incline was of an easier character, as we had time well in hand. On the 1 in 75 our speed fell to 26·6 miles per hour, although recovering near the summit to 27·3 miles per hour, and with a very easy descent of the bank we arrived at Penrith almost exactly on time. The particular features of the performance on this run to which I have called attention could really be described as phenomenal. In fact, one's vocabulary of descriptive adjectives of the superlative variety runs risk of exhaustion after a succession of experiences such as these. Mr. Bowen Cooke has every reason to be satisfied with the conspicuous success that has attended his comparatively short tenure of the responsible office of Chief Mechanical Engineer.

I have, in conclusion, to call attention to one or two errors which crept into my article in the last issue of the RAILWAY MAGAZINE. In the first instance "regulator" on page 75, column 1, line 3, should obviously read "reversing gear," as the "notch of his regulator" is a term which would not convey much meaning to a driver. On the next page, column 1, line 22, "Chelmsford" should read "Shenfield." Finally, on page 69, column 1, 5th line from the bottom of the page, "irrespective of" possibly conveys a wrong impression, and should be altered to read "after allowing for." My special thanks are due to Mr. F. E. Mackay for the splendid series of topical photographs with which he has been able to illustrate this article.

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Midland Great Western Railway:

THE NEW GENERAL MANAGER.

THE appointment of Mr. M. F. Keogh to be General Manager of the Midland Great Western Railway, in succession to Mr. Joseph Tatlow, has been received in Ireland with widespread satisfaction. As Secretary of another important company—the Dublin and South Eastern Railway—Mr. Keogh established a reputation for integrity, ability and courtesy which gave him a position of distinct eminence in the commercial community of Dublin. Following in his father's footsteps, his whole life has been devoted to railway work, and early in his career he obtained, as a parliamentary agent at Westminster, complete familiarity with the intricate routine of private Bill procedure, as also with the work of Royal Commissions and Select Committees.

Thus equipped, he returned to Ireland in 1898 as Secretary of the old Dublin, Wicklow and Wexford line, which afterwards assumed its more comprehensive title of the Dublin and South Eastern. With that office was associated the secretariat of the City of Dublin Junction and the New Ross and Waterford Extension Railways. He did much to promote the loop line which linked the Dublin and South Eastern with the Great Northern, thus enabling the mails to be carried through Dublin with greater convenience; and he was likewise instrumental in bringing to a successful conclusion the negotiations with the Postmaster-General relating to the subsidy agreed to be paid for the improved service. Subsequently he took an active part in the consolidation of the many different stocks that originally formed the Dublin and South Eastern capital. He held the position of Secretary for 14 years, and during that period rendered services of conspicuous benefit alike to the company and to the public.

Mr. Keogh's just reward has come in the high compliment paid to him by the directors of the Midland Great Western Railway, to whom his varied and mature experience will be of immense value. His knowledge of equipment and technical railway work generally is moreover remarkable in one engaged primarily in clerical duties, and to many talents he adds the charm of unvarying urbanity.

The Midland Great Western is now one of the great trunk railways in Ireland. At the incorporation of the company in 1845, the sole aim was to connect Dublin and Mullingar (with a branch to Longford), and in later days, the run of 50¼ miles between the two stations has been performed, without stop, in 1 hour 12 min., which is one of the fastest rail journeys in the country. The system now extends from Mullingar to Athlone, Galway, Recess, and Clifden, in the midst of the magnificent west coast scenery; from Athlone to Roscommon, Claremorris, Ballinrobe, Castlebar, Westport, Newport, Mallaranny, and Achill; and to Foxford, Ballina and Killala; from Mullingar to Crossdoney, Cavan, and Killesbandra; from Longford to Dromod, Carrick, Ballaghadereen, Kilfree, Colloney, and Sligo; and from Clonsilla (between the Broadstone terminus in Dublin and Lucan) to Kilmessan, Navan, and Kingscourt, as well as to Trim and Athboy. Thus the railway has established communication between Dublin and four important widely separated centres, while its enterprise is seen also in the opening of first-class hotels at Recess and Mallaranny, and the provision of motor car services (1) from Clifden to Leenane and Westport, (2) from Achill to Dugort.

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Mr. M. J. KEOGH,
General Manager, Midland Great Western Railway (Ireland).

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Some Branch Railways in South Devon.

(*Conclusion.*)

By
J. B. BARON COLLINS, M.A.

Photo] [*A. J. F. Bond.*

MORETONHAMPSTEAD STATION : GREAT WESTERN RAILWAY.

AN Ashburton Railway scheme was not revived till 1864, when a Totnes line was proposed with the title "Totnes, Buckfastleigh and Ashburton." This Act was obtained in 1865, the line to be 10½ miles long. The sod-cutting ceremony took place at Buckfastleigh with much rejoicing on August 3rd, 1865. Church bells were rung from early morn, and flags and banners decorated the town. The first section of seven miles was to be opened with a station at Buckfastleigh and one at Staverton, about mid-way. The line would be alongside the Dart for the greater part of the distance, and the contractors, finding it an easy line, engaged to complete the work within eighteen months as far as Buckfastleigh, and the extension to Ashburton within an extra six months for £100,000.

As far as I can ascertain, Buckfastleigh was reached in the autumn of 1868 only, and Ashburton in 1872—not very promptly after all! I cycled from Yelverton to Ashburton on Friday, September 3rd, 1909, having to walk much of the very hilly though beautiful part of the route near Ashburton, and had a good look at the stations and line. Ashburton station is roofed in and dignified, like that at Moretonhampstead, though quite small and of similar materials. There are Great Western semaphore signals, but no signal box at Ashburton. Buckfastleigh has a signal box and two platforms, but the up one has no shelter, and is not used by up trains apparently, unless a goods train may happen to be on the line as well. The station building at Buckfastleigh is of concrete. Staverton Church is very beautiful, and contains a magnificent oak (unvarnished) screen of the Devonshire type, with rood floor and wood at the top so finely carved and so thin as to look like lace. The branch runs into Totnes side by side with the main from Newton Abbot, an arched bridge of stone spanning the branch just before the junction is reached, and the Dart is crossed where it is still fairly shallow, adjoining the racecourse. On the day when the line was explored, Totnes races were in full swing, and the yard had some very long trains of bogie clerestory coaches of that handsome design which the Great Western introduced in or about 1874.

Totnes station is a wooden structure on the principle of North Road, Plymouth, but a very small and ancient forerunner, the platform lines being roofed and supported by wooden posts. There are two fast roads, unroofed, between the platform lines. The up train of the branch uses the down platform and *vice versa*. The old tower in the Italian style (as were the others) reminds one of the attempt to work the South Devon as an atmospheric line. There was a slight accident near Totnes in 1874 on the main line when the *Prometheus* ran off the rails, but owing to the longitudinal system of road the accident was not so serious, so it was stated, as it would have been on a cross-sleepered line, for the longitudinal on one side acted as a rail, keeping the flanged wheels from leaving the road altogether.

The Yealmpton line began as a short spur line from Laira yard to the station called Plymstock (at the hamlet of Pomphlett), one mile nearer Plymouth than the village of that name. The station at Plymstock is now a junction instead of a terminus, a short bit of line having been constructed to the little old-fashioned villages of Oreston and Turnchapel, worked by the London and

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South Western Railway with a rail motor car. The Great Western Railway work the Yealmpton portion, which is exactly eight miles from Lipson Junction on the main line, where there is a halt (only approachable by main line trains) and engine sheds. The Laira estuary is crossed by road and rail bridges side by side, both modern (the road one being nearer the sea), and opening up this part of South Devon, making it desirable for residences of Plymouth business men. Though small, the stations are built of stone, and are very close together, being slightly prior to the days of halts. There is a rise to Elburton and a fall to Steer Point, with pretty undulating scenery and slight cuttings and embankments. The last part of the line is by the estuaries of the Kitley and Yealm. There are signals at Plymstock, Brixton Road, and Plymstock.

Yealmpton is a pretty village, but though the station is close to it, it is in the parish of Newton Ferrers. It was intended to continue the line to Modbury, serving Ermington on the way; but for twelve years it remained in its first and second sections of Plymouth-Plymstock and Yealmpton portions. The platform is a long one, and station buildings at Yealmpton are on the south side of the line. Many thought that the Kingsbridge line ought to have come this way, instead of going northward to Frent, as most of the traffic was Plymouthward. The Kingsbridge line was authorised long ago. The first Act was obtained in 1864, but the South Devon Company were unable to make the line, and the powers lapsed. The late Sir Massey Lopes, of Maristowe, on the banks of the Tavy, in the parish of Tamerton Foliot, invested a quarter of a million in the Great Western Railway when a hundred-pound share was at 55 and 56, and readily went without any return for his money for some years. The Company made him a director, and he was very much the cause of the Kingsbridge branch being constructed. It was opened on December 19th, 1893.

Notice boards are fixed at either end of Sorley Tunnel, at which goods trains must stop to have brakes pinned down. This tunnel, a short one, is cut through the ridge between the Avon valley and the Kingsbridge basin, which is nearly all a tidal estuary. It would be somewhat costly to extend the line to Salcombe, as there are side creeks and valleys, and a steamer can convey passengers and goods. A Great Western Railway motor 'bus service now runs through the village of Marlborough to Salcombe from Kingsbridge station, connecting with all the principal main line trains. The line is brought round the west side of Kingsbridge, and the town almost left behind before the station is reached, bringing the railway some half-mile nearer Salcombe than might have been expected.

Photo] [*A. J. F. Bond.*

BOVEY TRACEY: GREAT WESTERN RAILWAY.

In the view of Newton Abbot station

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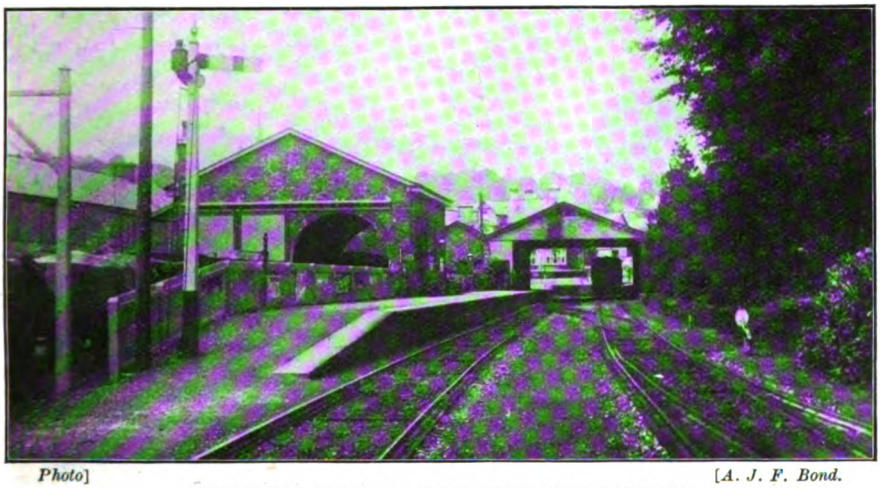
(published last month) there is an engine of the "Duke of Cornwall" class, No. 3287, *St. Agnes*, at the tail end of an up train. There are no pocket sidings or bays for branch trains, and Kingswear and Moretonhampstead trains usually use the middle part of the station, sometimes leaving simultaneously, as if two engines were having a game at tug-of-war with what looked like one train of carriages. There is a weather-cock in the shape of an old broad gauge engine on the roof of the works, which are on the down side.

Totnes station is at the bottom of gradients in all of the three directions of railway, and therefore is not a favourite stopping place for expresses, though pressure has been brought to bear on the Great Western Railway to stop more trains at Totnes, the gradient difficulty always being given as the reason why the town does not get more advantages. There is a scheme (sanctioned on March 28th, 1905) to make a new double line from near Newton Abbot to a point near Brent, east of the Marley tunnels. There is a tunnel for each line, up and down, at Marley, the up being the original, which nearly tumbled in during the construction of the other in the summer of 1891, necessitating a road service for a few days for the long distance from Totnes to Brent, there being no intermediate station. The new line would have one long and much easier gradient up from Newton Abbot to Brent for fast heavy trains instead of up down and up stiff grades, and be a trifle more direct. It is planned to cross the Ashburton line near Staverton. No intermediate station is proposed.

Brent station is commodious, but the Kingsbridge branch plans were altered at the last moment, and the junction formed by a curve east instead of west of Brent village, making a direct run from London to the Kingsbridge line impossible. Ashburton terminus is peculiar in having both ends open, though the station building is so near the buffer blocks. At Heathfield, which has only one platform, as is usual on this branch, the Teign Valley trains use the signal box end of the platform, but not the side shown in the view. Mr. Herbert Rake kindly let me have a photograph of a South Devon engine with a Great Northern Railway sort of cab, driving wheels 5 ft. 6 in. diameter, cylinders 17 in. by 24 in., and wheel base 19 ft. 5½ in., constructed by the Avonside Engine Company, 1866, standard type as on lines west of Newton, four wheels coupled passenger saddle tank, "Pluto" class, re-numbered by Great Western Railway No. 2052.



Photo] [*A. J. F. Bond.*

ASHBURTON STATION: GREAT WESTERN RAILWAY.

The views of stations were taken by Messrs. Currie & Cliff, Teignmouth, for Mr. A. J. F. Bond, of 85, Fore Street, Bodmin. That of Brixham station is looking towards Churston. The refreshment room is a very primitive one, and, with the down platform one at Okehampton, the worst the writer has ever seen. This part of England is full of interest and very beautiful. Totnes is a fine old town with a noble parish church of red sandstone, including its tower, and there is a ruined castle, gateway tower

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across the main street, and some fine old houses, good hotels, and the attractive River Dart. I append a list of Great Western Railway turn-tables in the Newton Abbot-Penzance section as existing in 1910 :—

Place.	Diam. ft. in.		Place.	Diam. ft. in.	
Totnes ..	34 5		Launceston ..	45 0	
Laira ..	55 6		St. Blazey ..	55 6	
Plymouth	45 0	L.B.	Newquay ..	45 0	L.B.
Princetown	23 6		Truro ..	55 6	
Yelverton	23 6		Falmouth ..	55 6	
Tavistock ..	45 0		Penzance ..	40 0	L.B.

L.B. : Lengthening bars.

The following is an extract from Whitfeld's " Plymouth and Devonport in times of War and Peace " (pp. 371 ff.).

Before the days of railways in Devon the " Royal Devonshire Cheap Coaches with 6 horses " were in the habit of setting out every morning (1800-1840) at 6 and 8 (Sundays excepted), from the London Inn, Dock, (from January 1st, 1824, known as Devonport), calling at the Globe Inn, Plymouth ; Oxford Arms, Totnes ; Golden Lion, Newton. They arrived at the New London Inn, Exeter, " where they meet the Royal Devonshire. Bath, and London coaches every Tuesday, Thursday, and Saturday evenings at six o'clock." " Cheap and expeditious travelling " was offered by " the Royal Clarence Coach," which " sets out from the Prince George Inn, Dock, calls at the Commercial Inn, Plymouth, Seven Stars, Totnes, Globe Inn, Newton, and arrives at the Half Moon Inn, Exeter, at seven o'clock in the evening—Inside, 10s. 6d. outside, 7s. 6d. Performed by H. Whitmarsh J. Martin & Co." " Cheap travelling " was also placed within popular reach by " F. Goude, of the King's Arms Inn, Fore Street, Dock," whose " light balloon coach " left Dock for Exeter " every morning at six o'clock," the prices being the same. On the other hand the route from Exeter was accomplished in " the entirely new and elegant Royal balloon mail coach, on a much improved principle, which sets out every morning to the King's Arms, Plymouth, and the King's Arms, Plymouth-Dock, arrives at half-past eight, and leaves at half-past five in the afternoon. Fare, 11s. 6d. ; outside 15s."

A single footpad in early times stopped a coach going from Plymouth to Exeter with no weapon but a clasp knife, with which he threatened to stab the one man passenger, who handed over £10 4s. to avoid this attention. The others, three sisters, got off by each kissing the footpad. Towards 1829 " expeditious travelling by water " came into favour as auxilliary to the coach. Steamers plied between the Three Towns and Portsmouth, and coaches waited at the latter port to carry passengers to London. Mill Bay, dep. 12.30 a.m., Portsmouth arr. 4 p.m., London midnight, 23½ hours. " What would our forefathers have said to this ? " was asked in 1825. " This is going it with a vengeance : if our ancestors had done such things, Jehus, steamers, prads and all would have been burnt as sorcerers ! " Towards 1830 the Subscription New Light Coach, conveying 4 inside and 10 outside passengers,

Photo] [*A. J. F. Bond.*

CHURSTON (LOOKING TOWARDS KINGSWEAR) : GREAT WESTERN RAILWAY.

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left at 3.30 a.m. from Townshend's London Inn, Devonport; W. Avent's Crown Inn, Stonehouse; and Hannaford's Commercial Inn, Plymouth; through Ridgway (part of Plympton), Ivybridge, Buckfastleigh, Ashburton, and Chudleigh, arriving at the Half Moon Hotel, Exeter, at 4 p.m. It proceeded at 6 p.m. through Ilminster, Wincanton, and Salisbury, and arrived at the Bull and Mouth, London, at 3.30 p.m. on the following afternoon.

The same company ran coaches to Bristol, Bath and London, and to Birmingham, Manchester, Sheffield, and Liverpool. No racing was allowed. "The new and splendid *Erin*," of 500 tons burthen and 180 horse-power, left Catwater for London, and dropped passengers up the Thames every Saturday, "taking goods and passengers, horses and carriages." The proprietors of this fine vessel take the opportunity of informing the public that it is their intention *to continue her sailing throughout the winter* and hope for a continuance of favours, particularly when it is considered with what certainty she performs the voyages." So early as 1830 the germ of the motor can occurred to a Plymouthian, Mr. John Lee Stevens, who advocated the application of steam to stage coaches, so that transit between Plymouth and Devonport should be rapid and economical. Mr. Stevens's company did not float, but he found consolation in having first proposed this particular method of utilising one of Mr. Gurney's engines.

List of Railways in Devonshire or Affecting Devonshire.

Mr. Baron Collins supplements his contribution by the following particulars, which many readers will, we are sure, be anxious to preserve as supplying a useful historical record:—

Railway between.	When opened.	Remarks.
Bristol-Bridgwater	June 13th, 1841.	London (Paddington) to Maidenhead (Taplow), 1838; Twyford, 1839; Faringdon Road, 1840; Bristol, 1841.
Bridgwater-Taunton	June 1st, 1842.	
Taunton-Whiteball Tunnel	May 1st, 1843.	
Whiteball Tunnel (incl.)-Exeter .. .	May 1st, 1844.	Since 1882 Exeter has ranked as a port owing to a canal.
Exeter-Teignmouth	May 30th, 1846.	
Teignmouth-Newton Abbot	December 31st, 1846.	
Newton Abbot-Totnes	July 20th, 1847.	
Totnes-Laira (Plymouth)	May 5th, 1848.	Mutley station opened, 1871; North Road opened, 1875. The opening ceremony by the late Prince Consort was on 2nd and working to Truro on 4th. Penzance, March 11th, 1852; Falmouth, August 1th, 1863: Bodmin, May 26th, 1887. The West Cornwall was opened in sections, the Truro end last, and before the Cornwall Railway reached Truro, the oldest part being from Hayle to Redruth. Helston branch, May 9th, '87.
Laira (Plymouth)-Mill Bay (Plymouth)..	April 2nd, 1849.	
Plymouth-Truro	May 2nd, 1859.	
Taunton-Hendford	1853.	
Watchet Branch	1862.	
Minehead Extension	1874.	
Taunton-Chard	July 11th, 1866.	
Hendford-Yeovil	Nov. 12th, 1868.	
Tiverton Junction-Tiverton	June 12th, 1848.	The Tiverton branch was worked at first by Adams' steam coach, 39 ft. long, with one first compartment and two seconds.
Tiverton Junction-Hemyock	May, 29th, 1876.	
Norton-Wiveliscombe	June 8th, 1871.	
Wiveliscombe-Barnstaple	Nov. 1st, 1873.	
Newton Abbot-Torre	January 1st, 1849.	For Torquay. Brixham was opened soon after Churston.
Torre-Paignton	August 1st, 1859.	1862. Extension of time Act to reach Kingswear.
Paignton-Churston	March 15th, 1861	1866. Churston, formerly Brixham Road.
Churston-Kingswear	August 16th, 1864.	S. Devon acquired all these.
Newton Abbot-Moreton Hampstead ..	July 4th, 1866.	Incorporated 1862. Teigngrace Station, Dec. 16th, 1867.
Tavistock G.W.R. branch	June 21st, 1859.	For regular traffic on June 22nd. Yelverton station opened May 1st, 1885.
Tavistock-Launceston	July 1st, 1865.	
Totnes-Ashburton	May 1st, 1872.	
Heathfield-Ashton..	October 9th, 1882.	A short bit beyond to Teign House siding was completed, but not used. This was near Christow station.
Tiverton-Morebath Junction	August, 1884.	

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Railway between.	When opened.	Remarks.
Tiverton-Exeter (near)	May, 1885.	Joins main line near Exeter.
Salisbury and Yeovil	May 1st, 1859.	Nine Elms-Southampton complete May 11th, 1840; Waterloo, July 11th, 1848; Bishopstoke (Eastleigh)-Salisbury, March 1st, 1847: Basingstoke-Salisbury, June 1st, 1857. Old Bishopstoke Branch station.
Yeovil Junction-Exeter	July 18th, 1860.	
Exeter-Crediton	May 12th, 1851.	
Crediton-Barnstaple	1854.	Broad gauge. Taken over by L. & S.W. in 1860. Narrowed in 1872.
Barnstaple-Bideford	1855.	
Bideford-Torrington	1872.	
Barnstaple-Ilfracombe	July 20th, 1874.	Doubled in 1889-91.
Yeoford Junction-North Tawton ..	Nov. 1st, 1865.	Yeoford (Colebrook Junct.)-North Tawton opened in 1868.
North Tawton-Sampford Courtenay ..	January 8th, 1867.	
Sampford Courtenay-Okehampton ..	October 3rd, 1871.	
Okehampton-Lydford	October 12th, 1874.	Ran over G.W.R. Lydford-Plymouth and on by short new spur line to Devonport, May 17th, 1876.
Okehampton-Holsworthy	January 20th, 1879.	
Yelverton-Princetown	August 11th, 1883.	Independent line for Lydford, entering Devonport other end and on to Plymouth, May 30th, 1890.
Barnstaple Loop	June, 1887.	
Halwill Junction-Launceston	July 27th, 1886.	Extensions: Tresmeer, July 21st, 1892. Camelford, August 14th, 1893. Delabole, October 18th, 1893. Wadebridge, June 12th, 1895. Bodmin, November 1st, 1895. Padstow, March 27th, 1899. Holsworthy to Bude, August 10th, 1898.
Barnstaple-Lynton	May 11th, 1898.	
Bideford-Westward Ho!	August 20th, 1901.	
Exeter-Exmouth	May 1st, 1861.	
Seaton Junction-Seaton	March 16th, 1868.	
Sidmouth Junction-Sidmouth	1873.	
Tipton St. John's-Budleigh Salterton ..	1897.	
Axminster-Lyme Regis	August 24th, 1903.	
Brent-Kingsbridge	December 19th, 1893.	Act first obtained in 1864, but the powers were allowed to lapse, as the South Devon could not afford to construct it.
Exeter Railway (Exeter-Ashton) ..	July 1st, 1903	
Budleigh Salterton-Exmouth	June 1st, 1903.	
Weston-super-Mare Loop	March, 1884.	
Yatton-Cheddar	1869.	
Cheddar-Wells	1870.	
Portishead-Bristol	1867.	
Laira-Plymstock	Part 1823, part 1892	Old Dartmoor Railway of 1823 partly used.
Plymstock-Turnchapel	Sept. 5th, 1892.	
Plymstock-Yealmpton	January 17th, 1898.	
Lipson and Mount Gould curve in Pl'm'h	April 1st, 1891	
Plymouth, Friary station..	July 1st, 1891.	L. & S.W.R. terminus.
New 'station' at Dartmouth	March 31st, 1890.	
Lostwithiel-Fowey	Sept. 16th. 1895.	Constructed in 1862. Brought under control of Cornwall Railway, August 25th, 1865. In its modern and extended narrow gauge form, after years of disuse, C.M.R., April 20th, 1877.
Liskeard-Combe Junction	May, 1901.	
Chacewater-Perranporth	July 6th, 1903.	
Perranporth-Newquay	Jany. 2nd, 1905.	
Looe Line, taken over by G.W.R. ..	Jany. 1st, 1909.	
Newquay and Cornwall Junction ..	July 1st, 1869.	Minerals only, by way of St. Dennis to Burngullow broad gauge branch at Nanpean.
Pool station, re-named Carn Brea ..	November 1st, 1875.	
Bere Alston-Callington Road	March 2nd, 1908.	
Doubling of line, Kingskerswell-Torquay	March 26th, 1882 (Sunday)	Inspected by Col. Yolland, March 8th, 1882.

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Leaves from the Log of a Locomotive Engineer [No. V.]

By ROBERT WEATHERBURN.

AS CHEF MONTEUR.

I WISH the reader to understand that the chapters immediately following, under the heading "Chef Monteur," were prepared in 1903, and intended for separate publication. The explanatory part was written in the third person, with the dual object of preserving the anonymity of the writer and of affording the opportunity of making a passing reference to Mr. Fitz, who some years previous to my advent in Russia, had among other noteworthy feats, transported a 26 ton locomotive on sleighs, for over 200 versts, enabling the contractor to work both ends of the lines at the same time—a feat which can only be understood by those who, like myself, have had the conveying of locomotives in winter by means of roughly improvised and constructed sleighs, the weight and nature of which, when loaded, minus brakes or steering gear, are most difficult to control on gradients, and further in my case, as no doubt in his, involve the strengthening of light bridges before being allowed to pass over.

The reader will no doubt inquire what is a "Chef Monteur," and why is a French term used where an English one would be more readily understood? I answer that although the English tongue is the most generally spoken, and as a rule the most expressive, yet, in this case it shares with the German and every other European tongue the reproach of not being able to give an equivalent and comprehensive title for the several duties and qualities, which come under that head. "Foreman in charge, Chief Erector," are the nearest English equivalents. Moreover the title is generally used throughout Northern Europe. A "Chef Monteur" is often the only agent or "go between," and figures as an expert where technical or mechanical difficulties arise. He was the outcome and product of locomotive industry at a time when skill, coupled with self-reliance, hardihood, and industry, were needed to push work to a successful issue.

Such men at that period could almost be counted upon the fingers, and yet leave some to spare. They were eagerly picked up by the various railways, and placed in positions of trust. Adaptability and resourcefulness were among the chief qualities required when necessity compelled the unloading of machinery on some primitive coast or small seaport, where steam or hydraulic cranes were unknown, and where lifting gear, if any, was confined to home made wooden cranes, the capacity of which was not more than was required to lift a crate of crockery, or a bale of Manchester goods; the rapid improvising of shear legs or derricks from the trees of the nearest forest, or the strengthening of the booms of the schooner-rigged steamer by lashing railway rails on either side, to provide for the lifting in safety of the slumbering giants stored deep down in the hold of the vessel. Such men had to be skilful and cautious in the making of fastenings, and able to shame half the "salts" who could be found on present day steam "tramps," in binding a rope or reefing of blocks, indeed in going through the whole category of expert knots, from the single and double hitch, reefer and bowline to the complicated Turk's head.

In the halcyon days of English engineering enterprise, when Northern and Southern Europe were sharply contested by England, France and Germany, *le chef monteur* was, like the wandering Jew, to be met with in the most unexpected places. Erecting his engines in the old Government workshops at the Perekop, or eating sturgeon *marinade* in the Hotel Richelieu, Odessa, and less than a year later during his well earned leisure picking up derelict amber on the sands at Pillau. He was hobnobbed with in an obscure town in Russian Poland, where he was the sole Englishman, and seen at Weirbolov in midwinter in the open—without shed or roof of any kind, with the deep crisp snow for flooring—erecting his engines with the aid of the village blacksmith and a handful of peasants, engaged at extortionate

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prices (as money there runs) rather than wait for the advent of spring. Neither kith nor kin of his would have guessed the identity of the muffled figure and capoted head, the moustache and beard stiff and white, the ends frozen to the collar of his coat where the congelation had formed in small chunks of ice. Seven months afterwards he was stumbled across in Aarhuus, in the Island of Jutland. where he had just finished unloading several engines for the Danish Government Railways.

He represented a class which has now, I regret to say, become nearly extinct. From such as he one half of the original railway engineers were recruited for the North of Europe and Scandinavia. Some years previous to the experiences hereafter narrated, one of the same class of hardy and determined toilers undertook to sledge a 26 ton locomotive over 200 versts, which task involved the crossing of frozen rivers, and streams and one lake, the latter resulting in the loss of his charge for some time, the ice, close to the shore, being so thin, through the action of a hidden spring, as to let the sledge through, undaunted he, by the aid of the Russian *Plotniks*, the finest axemen in Europe, felled and prepared trees, piled and coffer-dammed the partly submerged engine, baled out the water by means of swinging scoops, and put it on *terra firma*, did the ballasting of that section of the road, and left his bones in Reval, but with a reputation for resolution and pluck, that was for years the common talk in every Traktir and Kabak in that part of Russia. Yet as another instance among many that could be narrated the following may be cited as an illustration of some of the difficulties experienced in a winter remarkable for its exceptional earliness, and severity.

Several locomotives intended for the Central Provinces, having been much delayed in construction beyond the date of delivery, were consigned to the nearest open port in the Baltic. The steamers chartered were all put under the "ice-clause" risk, which meant that if ice bound—no uncommon occurrence in those days—the expense of the ship and the crew would fall upon the charterers during the whole period of detention and until the date of the vessel's release. The condition in the charter represented a sum varying from £40 to £50 per diem for hire, wages and maintenance of crew. Our *Monteur* had for many days been wearily waiting the arrival of the locomotives. The harbour was already frozen up, and the offing, so far as the eye could reach, was a mass of pack-ice rapidly consolidating, while he was anxiously waiting for the signal from the light-house at Doms Ness to announce the ship's arrival. It was known that they had passed through the Sound some days previously and he was hoping against hope, when at last the news was semaphored that a steamer answering

REVAL HARBOUR AS AT PRESENT.

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the description of one of the Hull boats was outside the ice belt, where the troubled water kept partially free from ice.

Promptitude was the word. A small but powerful and heavily-plated "wrecking" steamer, which had been laid up during the winter in the Mole, was speedily engaged and got ready to make the attempt of cutting a canal through the ice and keeping it open between the harbour, and the open roadstead. The price to be paid for its keep was 200 roubles per diem, and the proviso was inserted in the contract that the *Monteur* and staff should assist in making an opening through the harbour ice, and keeping it open. This latter task was speedily accomplished, and the hardy Norse captain, with his stubbornly built craft, was soon bucking and butting his way through the two miles of icy obstruction. On the following day they had the infinite pleasure of getting the vessel into port, when two other steamers, containing the remainder of the cargo, were sighted. These also fought their way through the "canal"; but bitter disappointment was experienced when it was learned that neither of the small schooner-rigged steamers were fitted with the needful appliances of steam winches and blocks of adequate strength.

Blocks were at last borrowed from a Russian frigate, which was canvassed over for the winter, but the needful adjunct of a sound 6 in. rope was not to hand. However with the aid of the English Consul, one was found at a local makers', but unfortunately it was tarred—a serious defect in winter, as the tar freezes, and prevents the gradual elongation of the rope when under strain.. With a pair of spars that had been lying idle on the old wooden quay for some years, shear legs were speedily rigged up after being scaled of the ice and snow with which they were encased, and, with the aid of an old-fashioned capstan, manned by bars, three engines with tenders, packing cases and wheels were successfully landed upon the quay. The task was rendered infinitely greater in consequence of the bitterly cold season, compelling all to work with mittened hands, while the hatchways were so small as to necessitate the lifting of the engines endways from the bottom of the hold. At the third lift the rope broke, and the engine fell to the bottom. It would undoubtedly have gone clean through the hull into the sea, had it not been for the foresight of the *Chef*, who availing himself of a few out of several scores of bales of cotton which formed part of the cargo, had, on the engines being lifted clear of the kelson, ordered them to be pitched underneath so as to provide against the possibility of such an accident. As it was, the only damage which occured was that a portion of the flange of one of the cylinders was broken but it was afterwards most cleverly repaired, though at a fancy price, by having a piece burnt on at a local foundry.

The two steamers were got out to sea just in time to escape the *Bolshoi Maros* which set in 16 hours afterwards, and scored 6in. of ice in one night. During the time of unloading, men were kept constantly employed breaking the ice around the vessels, but the difficulties were not yet over. The quay, built on wooden piles, was not intended for such heavy weights, and soon took such a deflection, that the town authorities, seriously alarmed, came in a body and insisted upon the immediate removal of the engines—no easy matter as the railway was some considerable distance away on the other side of the town, and there was no rail communication Sledging them was the only available means, but no vehicles strong enough to carry the boiler, frames and cylinders were known in that part of the country. Of timber however there was plenty to be had ready cut to nearly all merchant sizes as the Northern shores of the Baltic supply nearly one half the wants of England, *Plotniks*, or Russian joiners, were to be had for the seeking as the building trades were suspended in winter. Securing the address of a likely master man, the *Monteur* hurried thither, and in a few minutes sketched out the form of sledge which he required. It was to consist of three 4 in. planks by 9 in. depth, 10 ft. length, to be used edgeways, the ends slightly rounded, and roughly but strongly cross-stayed, and further secured transversly by five 1 in. bolts. The price was arranged contingent upon the celerity shown in their making, and on the following day, two such sledges were at his disposal. Upon these a couple of the locomotives were speedily "jacked." Long hauling ropes were hitched on, and by means of manual labour only, they were hauled through the quiet old streets of Reval. In less than two days they were mounted on 400 Centner trucks *en route* to Vologda. Such operations may be simple enough when effected through the media of steam or hydraulic cranes. But the problem was very different where no such aid existed, when even the very ropes had to be bought, or borrowed, far from help of any kind, and when the *Chef*

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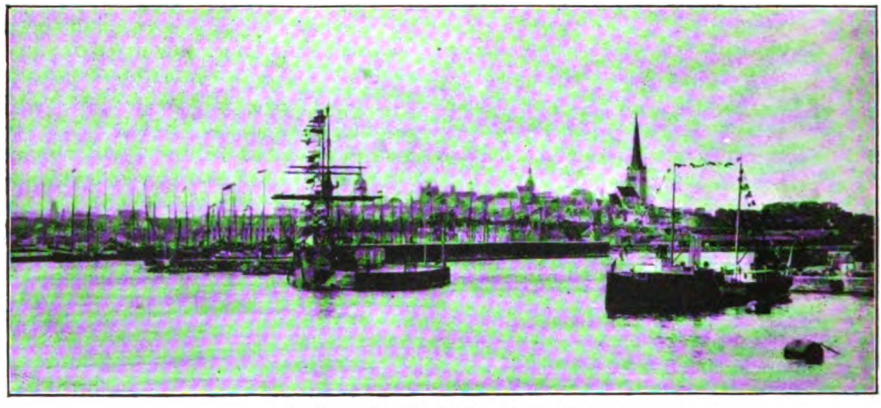
was left to his own resources, and had to perform every operation of knotting, splicing and fastening in a temperature 70 degrees below freezing point. By reference to his bulky but carefully kept dairy, and from what I had known previously, I collated the material for a further sketch of the *Chef Monteur* which may be accepted as unquestionably authentic. To prevent any loss of interest, and to keep his personality to the fore, I shall now use the first person singular both in narrative, records and impressions from the date of his departure.

September of the year 1869 found me on the good steamer "Leo" of Hull, bound for Cronstadt, with a miscellaneous cargo, the principal of which consisted of railway material. My passport had been properly *viséd* at the Russian consulate, and I felt myself at once proof against all molestation and hindrance. To describe the passage in full may not be accounted of sufficient moment, but to omit it altogether would be to despoil the memory and associations of their earlier impressions. Is it possible for an Englishman to pass between the shores of Sweden and Denmark, to sight for the first time the Castle of Elsinore without having his mind filled with deep interest in viewing the supposed birthplace of Hamlet, in gazing on the land of the Vikings, and in viewing as in a distant mirage the salient points of the coast of Sweden, and yet not to remember the glories of Gustavus Adolphus, and the heroic but unfortunate Charles XII? As the fair panorama opens out more fully, one catches a distant view of Copenhagen with its splendid Mole, zealously guarded by the Crown and other forts, like a happy face which in smiling, shows its teeth. And then, can he fail to remember that these are historic waters, the scenes in which the mighty and far reaching hand of England has twice played its part, and not recall the scene on the deck of Nelson's ship—the signal of recall, the telescope applied to the sightless orb, the order to keep the battle-flag flying. Add to these the glorious defence of the Danes, the magnanimity of their conqueror, and the death of Riou. Not to remember and recall the stirring acts in the drama of history ere the good and hospitable shores of Denmark sink far astern is to be unworthy of one's birthright. Not to know, that the shores fast receding from vision, gave to our national character its sailor leaven, would certainly augur badly for Britain. The sharp sound of a bell with the simultaneous appearance of the steward, "Dinner ready, Sir," puts however to flight the phantoms of Admirals Nelson and Parker, and you leave the sentiment for the practical, exchange history for soup, and fighting Admirals for roast beef of old England.



ANOTHER VIEW OF REVAL HARBOUR.

Having entered the Baltic, still keeping in sight for some hours the coast of Sweden and Denmark, we feel the change. The waters have a blueish tint, and the porpoise no longer gambols around. Small craft tend to enlighten the scene for a short time until the sea view becomes somewhat monotonous. So time goes by, occasionally enlivened by the view of distant islands, until we enter the Gulf of Finland. Here the scene becomes decidedly lively, and picturesque—the distant shores often wooded to the waters edge, while the placid surface, dotted with hundreds of craft,

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betokens a rapid approach to our destination. The looming up from the waters edge of mighty forts like Constantine-Paul and Michael—some placed in mid-channel, others flanking, and counter-flanking—told us better than words that we were at last at Cronstadt, Russias chief naval arsenal. The orders "slow the engine," "prepare the ladder," soon received their explanation by the arrival of a government boat with officials who having boarded, summoned us to the cabin, where our passports were separately demanded, and carefully examined, I myself being subjected to questions as to the nature of the business I was about to transact.

Here for the first time was I confronted with the officialism of Russia—so general in its application, so complete in its organization. Bidding farewell to the good ship and pleasant company, I was transferred in charge of an officer of customs to a river steamer, the deck of which afforded me a picture of the peculiar types of Russian and continental life. Social and official status was sharply defined by the severe, and distinct line drawn between them. The difference of dress rendered the scene alike attractive, and repulsive. Officers, with their wives and families, were largely predominant in making excursions from the garrison of Cronstadt to St. Petersburg, neatly and not ostentatiously attired in undress uniform, their bronzed visages gave them a service look very unlike the dandified Officers of the Imperial Guard. As a rule well dressed, the ladies were one and all engaged in animated discourse, regaling themselves much to my astonishment with occasional cigarettes which were lighted, and in some instances prepared by their male companions. I noticed with surprise the marked difference in visage between the governing and the governed classes, the upper class having refined features with a truly intellectual cast, the lower class, one and all, being exceedingly dirty in dress and habit, and generally repulsive in features. Although the weather was tropical in its heat, several of them were clothed in greasy sheepskins, the majority in dirty striped cotton garments, and the legs swathed round with rags. One remarkable peculiarity which has ever been noticed by all visitors is the peculiar smell which greets one in Russia—a combination of sheepkins, leathern hose and filth. A more dilapidated and forlorn lot of ragamuffins it would be difficult to find than the habitués of Cronstadt and the quays of St. Petersburg. Sir John Falstaff's "ragged brigade" would have mutinied to a man, before allowing such to hold fellowship with them.

MEM.—In describing the character of the late Mr. Stroudley, and in consideration of the fact that he was the first to dispense with the outside rigs and other appliances, and thus impart an unbroken contour, which was acknowledged by all at that time as being the "*right thing*," Mr. Weatherburn, in the last issue of the RAILWAY MAGAZINE, used the term "æsthete," not "athlete," as printed.

MR. WEATHERBURN'S reminiscences appearing month by month in the RAILWAY MAGAZINE under this title, are, as we anticipated, attracting universal attention, and numerous letters in reference to them have been received by the author and by the Editor. One of these communications relates to the old Lancashire and Yorkshire engine *Audus*, illustrated in our December number, page 475, and the writer (Mr. H. Savilie) says: "As you suggest, the engine has been modernised. When built there was no cab; a photo of a similar engine . . . shows the engine as built; it has no cab and has a Salter balance safety valve on the fire box. It also has a four-wheeled tender, with wooden framing. There is a peculiar feature in the engine which you illustrate, and that is the apparatus at the leading end—apparently a long stroke pump, driven from a pin on an extension of the coupling rod, and through the medium of a forked connecting rod. Perhaps one of your readers can throw some light on this. It gives the engine the appearance of being an outside cylinder engine, but this is not so. There is also a plate on the angle iron above this fixing which appears to bear the legend '. . . Patent.' Another peculiar feature is the feed clack on the side of the firebox—a common Miles Platting practice at that period. The cab and Naylor safety valves were added by Mr. Hirst. I should put the date of the photo at 1870-5."

Mr. Weatherburn replies as follows to the above inquiry: "Mr. Saville's letter affords a strong proof, if one were required, of the keen scouting and analytical interest with which the photos of old engines in particular are viewed by readers. His query respecting the long-stroke pump shown at the leading end of the engine, and driven from a knuckle joint on the end of coupling rod, through the intermediary of a forked rod, steadied by a tail piece, and guide, is interesting. The apparatus was known as 'Warsop's Patent Air system,' and I am enabled by the courtesy of Mr. G. Hughes, Chief Mechanical Engineer of the Company, to

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give the following details: It consisted of an air compressing pump, as fixed, and air heating coils arranged in the smoke-box, the object aimed at being the aeration of the water, and the prevention of scale formation in boiler. The late Mr. Riches, of the Taff Vale Railway, experimented (presumably) to the same end on or about the year 1871-2 by fixing a fan under the tender tank and driving it from one of the axles, the object being (as I was informed) to aerate the feed water and utilise its expansion when heated in the boiler in conjunction with the steam. It was claimed for the Warsop system that it prevented the formation of scale, but the idea is too chimerical to be seriously entertained. The only effective way for preventing scale is to deprive the water beforehand of all foreign matter, without making it too soft. Mr. Saville is not far out in his date of the photo, viz., about 1872, for the Naylor's safety valve and the style of cab are confirmatory of that period. The practice of affixing the feed clack on to the firebox was peculiar to the Lancashire and Yorkshire Railway, but reprehensible. There are several other features more or less interesting in the details which should strike the eye of the observant. In the decade 1870 to 1880 the obtrusive details of design, such as the positioning of clack boxes, pump, injectors, steam jets, cylinder cocks, and ashpan gear, lubricators and pipes began to receive the careful attention they merited at the hands of locomotive engineers, particularly Stroudley, Stirling, Webb and Johnson. A judicious and less obtrusive arrangement was not only more economical and less noisy, but imparted a chaster and simpler appearance to the engine much in contrast with what had gone before, and such as a momentary comparison of Continental and British engines affords even now, although it must be admitted that nearly all Continental builders are rapidly copying us in that respect. The practical and æsthetic standpoints from which they have been considered have been largely due to the trained eye and close study of recurrent repairs (in the Repairs Book). No man brought clearer and greater powers of observation to bear and united the qualities of the practical engineer and the æsthetic more than Stroudley, whose training was of such a thorough character as is rarely known nowadays, and happily grafted to a *con amore*, without which no signal success can be obtained.

"Among the many other pleasant and interesting letters I have received from nearly every country where the RAILWAY MAGAZINE has penetrated—and some where I had thought it had hardly found its way—require special personal acknowledgment. Those from old friends, old pupils, and acquaintances, with their earlier associations which have unexpectedly come to hand, must needs wait (and in this I feel sure of the kind indulgence of the writers) while I give first place to those from correspondents with whom I have not the vantage ground of former acquaintance or being more urgent, the majority of which letters have been courteously forwarded to me by the Editor. In this sense my first acknowledgment and thanks are due to Mr. A. Hancock, Consulting Engineer and Surveyor, Liverpool, for his kindly correction of Taylor instead of Williams as the owner of the Britannia Foundry, Birkenhead, where he received his earlier training, and to Mr. J. MacLean (the author of the book on North Eastern Railway Locomotives) for his friendly reference to my former contributions to the RAILWAY MAGAZINE. My thanks are also due to Mr. G. P. Tyas for his reference to my connection with locomotives and events at home and abroad many years ago. Nor must I overlook the long and interesting letter of Mr. E. Lyons, of Peterstone, Superintendent, Ely, Glamorganshire, whose experiences in South Wales and elsewhere are singularly reminiscent and corroborative of my own. My hearty thanks are due to Mr. S. Betts, formerly of Witepsk, Russia, and late Locomotive and Carriage Superintendent on the Flen and Westmansland Jernväg, Sweden; to Mr. C. King, Managing Director of the Hohenzollern Gesellschaft Locomotivbau Düsseldorf, whose linguistic abilities are only exceeded by his undoubted excellence as an engineer and successful designer of locomotives; to Mr. A. Whitaker, late Locomotive and Carriage Superintendent of the Somerset and Dorset Railway Company, whose inventions are too well known to need mention here, and whose memory for dates and events is so extraordinary as to suggest that he has been specially dowered by the goddess Mnemosyne."

[Mr. Weatherburn's sixth contribution will appear in the March issue of the RAILWAY MAGAZINE.]

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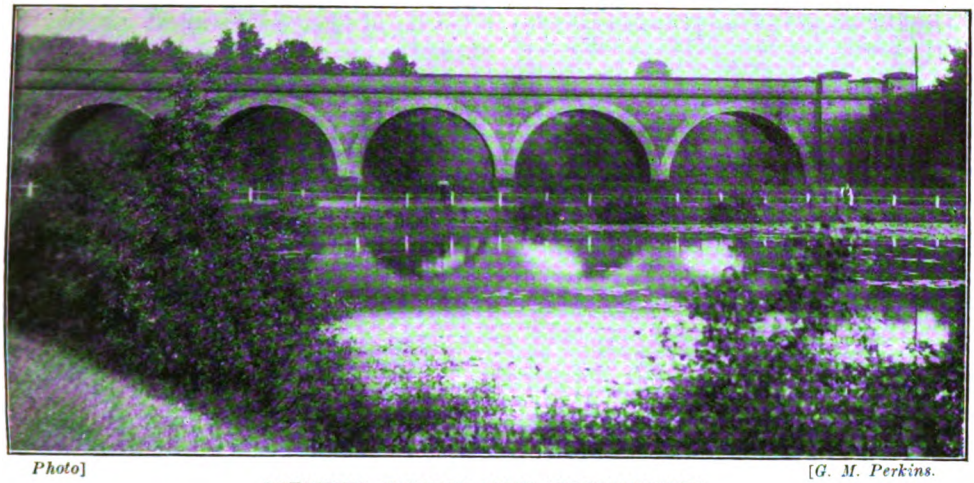

Photo] [*G. M. Perkins.*

CHURCHILL VIADUCT, NEAR KIDDERMINSTER.

The supporting wall of the old wooden viaduct may be seen on the extreme right.

The Oxford, Worcester and Wolverhampton Railway.

(*Concluding.*)

By HERBERT RAKE.

A BILL was brought before Parliament in the Session of 1848 for a deviation at Wolverhampton, to afford facilities for extended accommodation there, and for the construction of a station jointly with the Shrewsbury and Birmingham, and the Dudley and Wolverhampton Railway. An agitation had been raised in the locality that the narrow gauge alone, instead of a mixed gauge, should be laid between Tipton and Dudley. A rupture now occurred with the Great Western on their refusal to contribute the further capital required to complete the line, and the company having exhausted their available capital, the works were entirely suspended. A special meeting of the proprietors was called in June, 1849, at the instance of the Yorkshire shareholders. After an ineffectual attempt to carry a vote of no confidence, a committee was appointed to act with the Directors, and investigate the exact position in regard to the original understanding with the Great Western Railway, in other words, to ascertain whether through any want of precaution it could not be considered a *lucidus ordo*. The northern half of the loop from Worcester to Abbottswood was opened on October 5th, 1850, and worked by the Midland Railway under special agreement.

To complete the northern portion of the main line through to Wolverhampton (Priestfield Junction) would, it had been found, require about £750,000. Powers existed under the Acts of 1848 for an issue of capital to that extent, which it was determined should take the form of shares bearing a preferential interest at the rate of 6 per cent. The South Staffordshire Railway, which had entered into an agreement for the use of a joint station at Dudley, was now approaching completion, and by completing the line thence to Abbottswood, the Oxford, Worcester and Wolverhampton would secure a line of communication from the former railway, through Kidderminster and Stourbridge, to the Midland Railway from Birmingham to Bristol. The Directors now entered into negotiations with the London and North Western and Midland Railways, for a lease of their line jointly to those two companies, the agreement for which was embodied in the following terms :—

The line between Oxford and Wolverhampton to be completed on the narrow gauge, double

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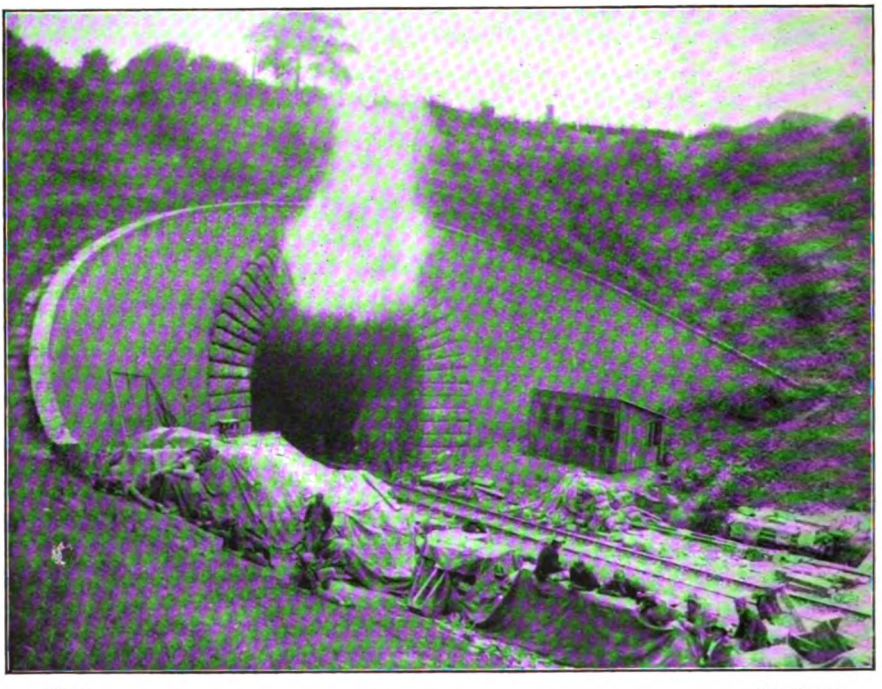
from Tipton, where they were in communication with the London and North Western to Moreton-in-the-Marsh, and single from there to Oxford; the latter to be doubled when the traffic required it. The line to be worked for 21 years by the London and North Western and Midland Railways, and the balance of gross receipts, after allowing for working expenses and providing for interest on the debentures and preference shares, to be divided in the proportion of two-thirds to the Oxford, Worcester, and Wolverhampton, and one-third to the London and North Western and Midland Railways, until the gross receipts exceed £150,000, when all receipts shall be equally divided.

With almost incredible *naivete*, the Report to the shareholders at the following half-yearly meeting added:—"Nevertheless, your Directors will be ready at all times to meet the Great Western Railway, in any fair arrangement which may be consistent with your connection with the narrow gauge." As was only to be expected, the Great Western applied for an injunction, on the ground that the proposal was in contravention of a previous agreement, under which the railway was to be completed to their satisfaction, and the gauge to be such as would admit of it being worked continuously with the Great Western line. They also deposited a Bill for the Wolverhampton Junction Railway, on the broad gauge—Priestfield to Wolverhampton—in connection with the Shrewsbury and Birmingham, Shrewsbury and Chester, and the Wolverhampton and Dudley Railway, the one link wanting in the new route to the Mersey (a subject which will be dealt with in a future article), and from the further construction of which latter the Oxford, Worcester and Wolverhampton were now to be shut out on being refunded the amount expended thereon. Apparently:

"One woe did tread upon another's heel
So fast they now do follow——"



Photo] [*J. Taylor.*

SOUTH END OF MICKLETON TUNNEL, AS CONSTRUCTED FOR THE BROAD GAUGE.

For in addition, the extension of time applied for by the latter, during which to complete their works, together with the further capital powers required, was only granted on the express condition that they became bound to complete the line to the satisfaction of the engineer of the Great Western Railway, under a penalty of £10,000 for non-completion by September 1st, 1855, and for every day after such date the sum of £500!

At the instance of a body of influential shareholders, the Railway Commissioners had been applied to, with a view to their

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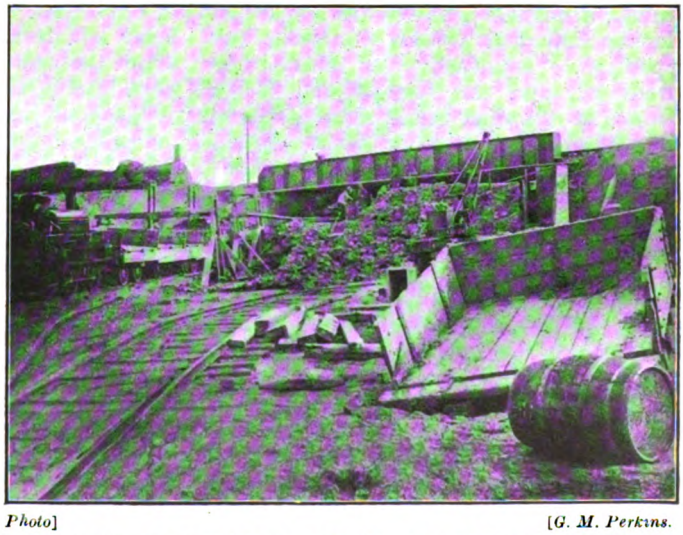
intervening in the dispute, and requiring, if possible, the Great Western to complete the line. But it was found that the agreement merely provided that if the line from Wolverhampton through to Oxford were not proceeded with in such a manner as to give due and reasonable security, that it will be finished within the time prescribed in previous Acts, then on one month's notice, the Great Western *may* enter upon and complete the line. It was now proposed that three years be given the Oxford, Worcester and Wolverhampton within which to complete the undertaking, the Board of Trade to be called on to determine whether the works were being carried on in such a manner as to ensure the opening of the entire line by the time specified. The proposed lease to the narrow gauge companies had fallen through, previous to the injunction being obtained upholding the contention of the Great Western. A joint committee of the respective Boards had been nominated to confer with the Directors, but at the last moment the representatives of the Midland appear to have required the appointment of a "traffic committee" so composed as to transfer the entire control of the traffic to the Midland jointly with the London and North Western. Such a condition in the absence of an absolute and unconditional guarantee it was felt impossible to accept.

The Directors now sought a meeting with the Board of Trade, the ultimate result of which was that the latter body agreed not to pursue the company for any penalties incurred antecedent to the date fixed for completion of the line, and the Great Western Railway, on their part, agreed not to fetter the application to be made to Parliament for powers to raise any further capital required, together with an extension of time wherein to execute the broad gauge works. It was estimated that at least £250,000 would be required for the purpose of completing the double line of broad gauge, while a further £250,000 was needed for locomotives and rolling stock. Consequently the meeting in the autumn of 1850 was decidedly stormy. On January 14th, 1857, a special meeting was convened in London for the purpose of considering an offer from the Great Western Railway to lease the line for 999 years, the former to receive one-third the net income, until the gross receipts exceeded £200,000 a year, and one-half the net income beyond that sum; but, as the proposal was tantamount to a lease in perpetuity without any guarantee, it was finally rejected.

There was, it seems, a provision for extending the line from Tipton to Wolverhampton, and a "mixed" gauge thence to Abbottswood, the portion thence to Oxford to be broad gauge only. Under the proposed lease to the narrow gauge companies it was intended to make use of the Birmingham, Wolverhampton, and Stour Valley line from Tipton to Wolverhampton, but it afterwards appeared that the object of the London and North Western, who had become owners of the Stour Valley line, was to work the Wolverhampton Railway's traffic, not down to Oxford, but to Moreton only—25 miles short—thence to Banbury, and over their Buckinghamshire line.

The proposal for a broad gauge track only from Abbottswood to Oxford, was regarded as most unjust, for the Great Western had decided on the mixed gauge through Birmingham and Wolverhampton. The



Photo] [*G. M. Perkins.*

SCENE NEAR HONEYBOURNE DURING CONSTRUCTION OF DIRECT BIRMINGHAM AND BRISTOL LINE.

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Shrewsbury and Hereford, and Severn Valley lines, the Worcester and Hereford (see vol. xxii., p. 55 and p. 410, and vol. xxvi., p. 23), also the Abergavenny and Hereford were all to be on the narrow gauge, so that between Oxford and Worcester they would be shut out from all the traffic which those lines in connection with South Wales might offer, especially if they could effect an outlet to the South at a future time over the Reading and Reigate line from Oxford. The Oxford and Brentford Railway was meanwhile planned, to afford the Oxford, Worcester and Wolverhampton an independent access to the Metropolis. It was to pass through Thame, Wycombe, Beaconsfield, and Uxbridge, to a junction with the London and South Western loop line near Brentford. But the Bill met with the most strenuous opposition of both the Great Western and the London and North Western Railways, and the scheme was rejected, although it was stated that the line would be quite 5 miles shorter than by the former to Paddington, and 18 miles shorter than the latter to Euston.

Under this provocation, the London and North Western proceeded to promote a Bill in Parliament for a line from Leamington, through Stratford-on-Avon to Worcester, where by means of the Worcester and Hereford, and Newquay and Hereford Railways, South Wales would be reached without passing over any part of the Oxford, Worcester and Wolverhampton line. This move placed the latter company in a quandary, and it was a question whether they had a *locus standi* for any opposition. Eventually the scheme was withdrawn, and the London and North Western re-deposited the Tring and Oxford Bill, with some modification. The scheme was passed, but appears to have been afterwards abandoned in favour of a connecting line between Oxford and the Buckinghamshire Railway *viâ* Bicester to Verney Junction. On February 10th, 1852, the line from Droitwich to Abbottswood, 14 miles, completing the Worcester loop, was opened, and on May 1st in the same year, 36 miles of the main line from Evesham to Stourbridge was opened for traffic, the whole being worked by the Mildand Railway. The right of the company to lay down the narrow gauge on their main line, in addition to the broad gauge, had been affirmed, and they had concluded arrangements with a contractor, for the supply of the locomotive and carrying stock necessary to work the line between Evesham and Stourbridge.

The railway was opened from Evesham to the junction with the Birmingham and Oxford Railway at Wolvercot, on May 17th, 1853. A special train ran over the whole distance from Dudley on this occasion, conveying the Directors, with the authorities of the several towns on the route. At Evesham the indispensable luncheon took place, and "all along the railway towards Oxford, crowds of people were assembled at the stations and bridges, to gaze upon the special train, which was made up of 26 first and second-class carriages, and was drawn by two engines. At Wolvercot the party changed carriages, and proceeded to Oxford, where in the evening they were entertained at a dinner given by the contractors. On representations from a body of shareholders in favour of a working arrangement with the Great Western, that company was induced to renew the former offer to stock the line with broad gauge plant, and work the line on the completion of the wider gauge; or to lease it on joint account; but if the traffic were sought to be worked on the narrow gauge between Wolvercot and London they declined any negotiation whatever. At the meeting of the proprietors in September, 1853, we find that the break at Wolvercot was obviated. Parliament had sanctioned the use by the Oxford, Worcester, and Wolverhampton, of the Great Western station at Oxford as a terminus for both goods and passengers from the former line, in connection with the narrow gauge then being laid from Oxford to Basingstoke, to afford through communication from Birkenhead to Southampton.

A serious trouble now arose, through the omission of the contractor to complete the second line of rails on the double gauge between Evesham and Honeybourne, which being reported by the Government Inspector to the Board of Trade, that body had not only refused to certify the line, but prohibited its opening under risk of all penalties. The company persisted, nevertheless, in opening the line on January 1st, 1854. One of the two lines of rails had been passed, and opened in the previous June, and it was contended that when one line was opened, the whole railway was opened! An injunction was thereupon obtained, to restrain the company from using the second or up line of rails, or any portion between Evesham and Honeybourne for the public conveyance of

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passengers, without the sanction of the Board of Trade, in defiance of which order, the company to forfeit a penalty of £20 per day, in addition to a similar penalty incurred for opening without permission, and be held liable for an illegal act. The broad gauge was then laid from Evesham, and in March, 1855, had been completed to Campden; the second line of mixed gauge between Handborough and Wolvercot had also been commenced, and the Chipping Norton narrow gauge branch 4½ miles in length, was approaching completion.

In the Session of 1855, a Select Committee of the House of Commons rejected the Bill introduced by the Great Western Railway, for the completion and usage of the broad gauge on the Oxford, Worcester and Wolverhampton line. A Bill was presented in the following year seeking power to remove the broad gauge where laid, but being opposed by the Great Western Railway, it failed to pass the House of Lords. The Directors now appealed to the London and North Western and Midland Railways for their assistance in securing the efficient working of the line on the narrow gauge, and the former supplied additional locomotives and worked the Southern half of the line. Ultimately, the company were able to contract for the supply of their own locomotives and carrying stock, and erected extensive locomotive and carriage shops at Worcester, which then became their headquarters. A Bill conferring further capital powers was passed in May, 1856, and a Select Committee decided to postpone for a period of 4 years the time within which the broad gauge lines were to be completed.

At this time the main line consisted of 31 miles double mixed gauge, 20 miles single mixed gauge, and 38 miles double narrow gauge, with single mixed gauge on down line. The Board now determined to press upon the notice of the Great Western that much valuable traffic was lost owing to the mixed gauge not being yet carried through to Paddington, as required by the Board of Trade to be completed within a period of two years. The mixed gauge had already been laid from Oxford to Reading and Basingstoke, so that it only needed the 36 miles between Reading and Paddington to be so laid, to give a narrow gauge communication with London (Paddington) from Oxford, Worcester, Hereford, and South Wales. At length, during the autumn of 1858, the Chairman was able to announce the heads of an arrangement with the Great Western Railway—ratified by Parliament in 1859—whereby they agreed to dispense with the completion of the broad gauge on the Oxford, Worcester and Wolverhampton line, which then became merged in the system of the West Midland Railway.

Photo] [*Lieut. B. D. Holberton.*

GREAT SOUTHERN AND WESTERN RAILWAY:
Cork-Dublin Express at Limerick Junction.
Locomotive No. 310.

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Railway Signalling in Principle and Practice [No. V].

By W. E. EDWARDS.

ELECTRIC TRAIN TABLET OR ELECTRIC TRAIN STAFF BLOCK SYSTEM.

IT has probably occurred to the observant reader that in the event of an unusual number of trains running in one direction only there must, in consequence, arise the difficulty occasioned by an accumulation of staffs (or tablets) at one end of the section. That contingency, however, was foreseen, and provided against by the regulations in the following manner. Should necessity demand, it is laid down that a properly authorised person be employed to rectify the inequality by transferring the overplus from the one end of the section to the other. This duty devolves upon the telegraph lineman, who is provided with a key, which enables him to open the staff (or tablet) apparatus. Before doing so, however, the lineman (who has been summoned) advises the signalman at the other end of the section as to what he is about to do by sending, the prescribed telegraphic signal, and the exact number of staffs, or tablets (which in the former case must be an even one), removed from the instrument are recorded in the staff (or tablet) register, while the signalman signs the entry, and records the time at which the operation takes place; the lineman being solely responsible for the custody of the staffs (or tablets) until he has deposited them in the instrument at the other end of the section. The signalman there, after receiving the regular staff from the engine driver, and placing it in the instrument, at once compares the number recorded in the lineman's register with the number of staffs (or tablets) received, and if satisfied that the matter is in order, and that the whole of the staffs (or tablets) have been deposited in the proper instrument, signs the register, and enters the time of the transaction.

Although due care is enjoined upon all concerned, it occasionally happens that a staff sustains damage in transit, nay, more, it may, at least temporarily, be missing entirely upon the train's arrival. Each of these contingencies is therefore provided for in the instructions. If a staff be so damaged that it cannot be placed in the instrument, the lineman is again summoned, and directed, in the presence of the stationmaster, or other responsible official, to adjust the apparatus so as to allow the staff working to be carried on without the damaged member, which must be taken away by the lineman. In the event of the staff being lost, single line working is temporarily carried on by a pilotman until the appliance has been found or the apparatus so adjusted by the lineman, that the traffic may be carried on without it. The same procedure is adopted in the event of the failure of the electrical apparatus, a remarkable example of which has been recorded in the case of a delay upon the Great Western Railway, when it was shown that the operation of the mechanism of a train staff instrument had been nullified by the presence of a blue-bottle fly! The

FIG. 1.

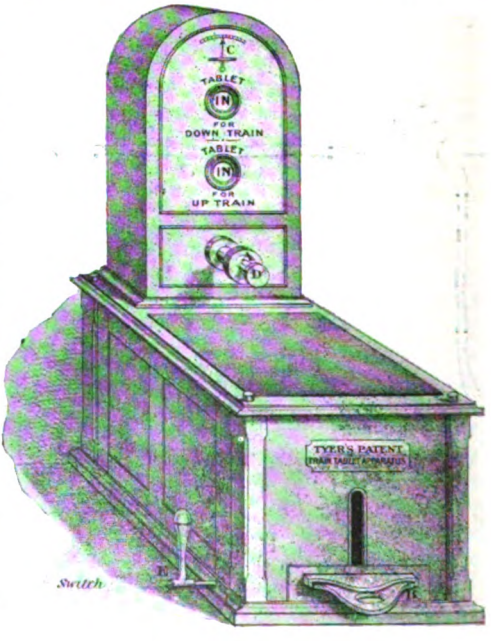

FIG. 2.
Tyer's Improved Train Tablet Apparatus.

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pilotman, it may be explained, is a competent man specially appointed for the purpose. He wears a distinctive badge, that upon the Great Western Railway consisting of a red armlet of the pattern illustrated by Fig. 1; and during the suspension of the regular working no engine or train is allowed to proceed in either direction, unless the pilotman personally orders the train to start or is actually present upon the footplate, occupying, in fact, the place of the staff or tablet. For that reason the pilotman is directed to show himself to the signalman as the train passes, while the regulations generally, as applying to this method of operation, are most carefully drawn. A similar procedure is in some cases adopted when, owing to obstruction or other cause, single line working is necessitated upon an ordinarily double line of railway.

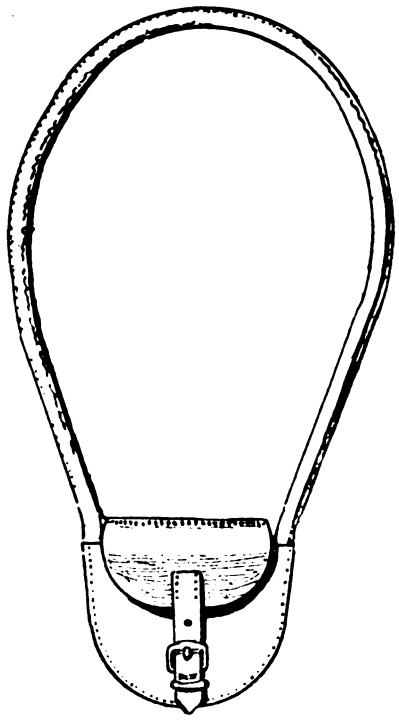

FIG. 3.
Tyer's Standard Pattern Pouch.

The Electrical Train-Tablet System.

It suffices to say that the principles, including the regulations applying thereto, are identical with those of the train staff, saving that the apparatus differs, and in lieu of staffs, metal tablets, some 5 in. in diameter, are employed. Selecting for illustration Messrs. Tyers' invention, the instrument mostly used in this country is represented by Fig. 2, its ruling principle being that of interlocking. Thus the issue of a tablet is perfectly safe at either end of the section, and the operation is under the sole control of the station towards which the train is travelling. The apparatus consists of two portions, namely, an "Absolute Block" signalling instrument, combined with a tablet apparatus. This "block" instrument has two discs, upon which are enamelled the signals "In" and "Out," these signals being alternatively exhibited through the circular openings in the dial plate. The upper disc is actuated by electric current; the lower disc, with the "commutator," is moved mechanically by means of the large gunmetal knob A, and the discs are so interlocked that the presentation of contrary signals is impossible. Thus, if the single line section between two signal-boxes be clear, both "up" and "down" discs indicate Tablet in," as in the illustration. The tablet apparatus essentially consists of a cylinder containing a set of train tablets consecutively numbered and lettered with the name of the section over which they are available.

To the lower portion of the cylinder is fitted a slide, B, retained in either "In" or "Out" position as required by means of double pawls, acted upon by two electro-magnets connected with the "receiving" portion of the apparatus. C is the galvanometer needle, D the ringing key, and E the switch, used for the purpose of raising or lowering the tablets in the cylinder. Needle C serves to indicate (a) the passage of each signal between the two cabins; (b) when the distant signalman holds down his plunger (as per code described) for the purpose of unlocking the slide; (c)

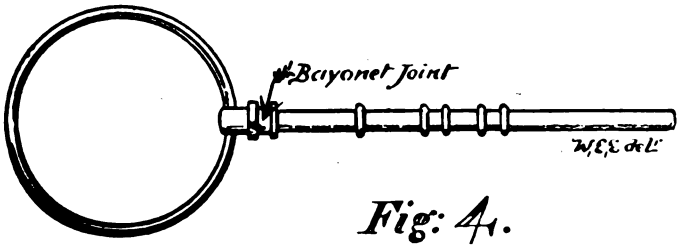

Fig: 4.

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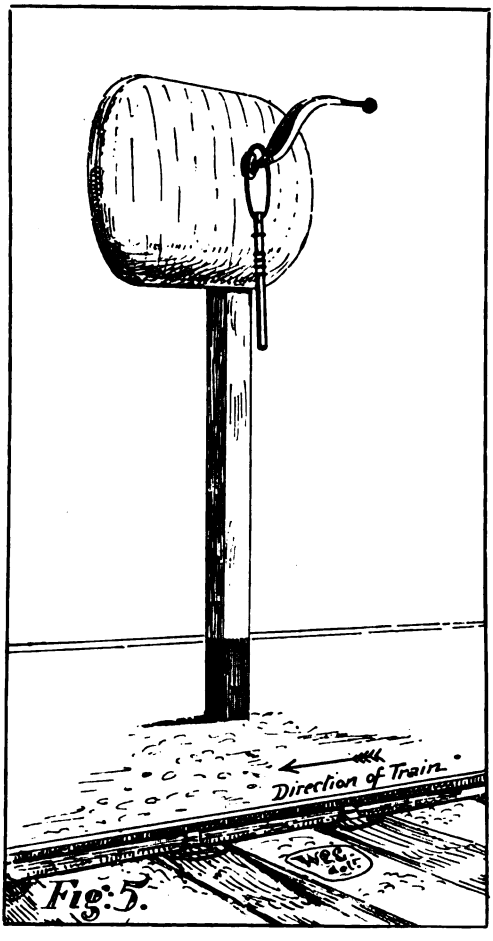

Fig. 5.

when the latter has been pulled out to the full extent; or (d) when it is pushed in, upon due receipt of the "clear" signal. The upper disc indicates that the line is "clear," as also when permission has been given by the signalman in advance to withdraw a tablet, say, for an "up" train. Then the lower disc indicates that permission has been received, and the "commutator" turned at the home cabin enables a tablet to be withdrawn, say, for a "down" train. The "commutator," A, being interlocked with slide, B, cannot be turned, nor can the slide be withdrawn or pushed back without the consent and co-operation of each signalman. Fig. 3 illustrates Messrs. Tyers' standard pattern pouch (in one form) used in the conveyance of the tablet, and suited, if required, for exchange *en route* by means of an apparatus of the character already described. Similarly with the staff apparatus, points or signals at intermediate places between stations may be locked, or unlocked, by means of the tablet. Under these systems of single line working the "Standard Clearing Point" regulations apply in so far as junctions or staff stations at which there is no facility for "crossing" two trains. Wherever a crossing loop exists it is only required that the line be clear as far as the starting signal, and the points set for the loop before "Train out of section" is sent to the stations in the rear.

EXCHANGE OF TRAIN STAFF BY APPARATUS.

In cases where the traffic is local, and the signal cabin is favourably situated, the train staff, as already noted, is handed from signalman to driver, and *vice-versa*; and in the event of the signal-box being at a

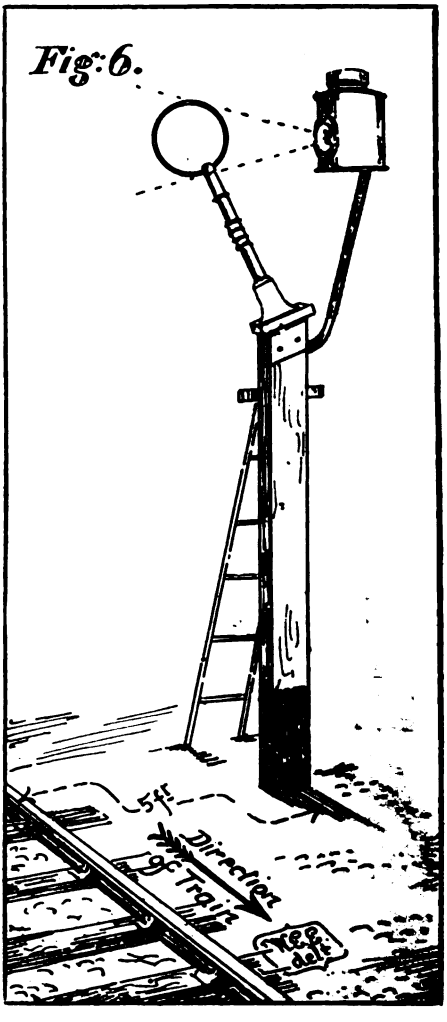

Fig. 6.

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distance from the stopping point, the speed is in such circumstances limited to 8 miles per hour upon the Great Western system. The conditions, however, are frequently such that a more expeditious method becomes necessary. Hence the adoption of the exchange apparatus, the system devised by the Great Western Company being selected first for illustration. Under this the speed limit is extended to 15 miles per hour. Signalmen are provided with sets of steel hoops, one of which is fixed to the train staff after its withdrawal from the instrument. To secure it in position, a bayonet joint is furnished, and the method of fixing will be observed in Fig. 4. At the passing loop, or train staff station, two posts are placed at specified distances from the rails, as well as from each other, the one being known as the "setting down" post, the other as the "picking up" post. Illustrated by Fig. 5, the former is fitted with a curved metal bracket, encased and conveniently pointed in the direction of the approaching engine, so that the fireman, in passing, slips the train staff hoop over the projecting arm—it must not be thrown on—whence it is fetched by the signalman. To prevent damage to the staff, a padded shield is provided, as the staff frequently travels to the position indicated by the sketch. For night use, a lamp is placed upon a separate post about 7 ft. distant, the light being directed towards the projecting arm.

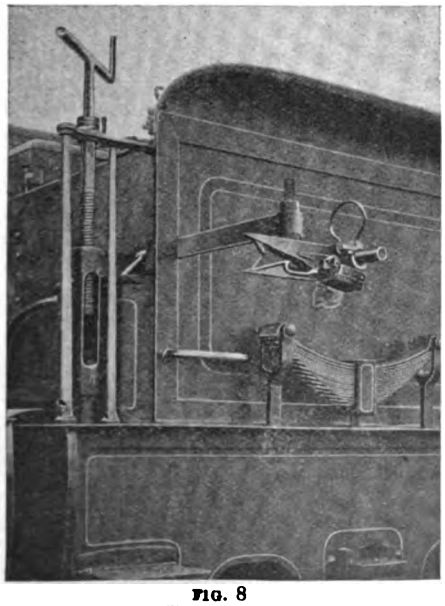

FIG. 8
Arrangement on Engine in Working Position.

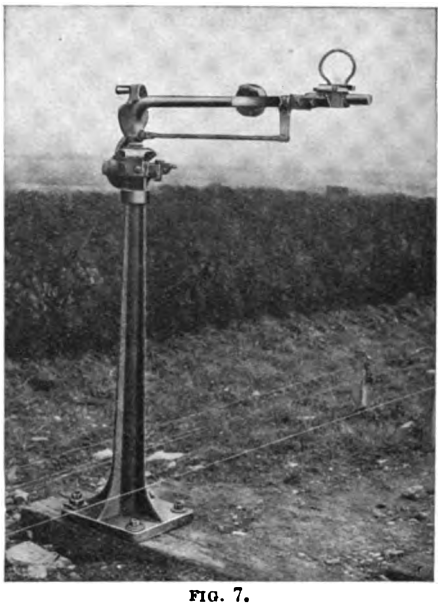

FIG. 7.
Deliverer at commencement of Single Line Section, Working Position with Staff ready to be delivered to Engine.

A "picking-up" post, illustrated by Fig. 6, is placed about 20 yards beyond the former, and is similarly fixed upon the "near" side, about 5 ft. from the left rail. At the top of the post is a spring-box, in which, as shown, the end of the train staff is placed by the signalman. As he passes, the fireman places his hand and forearm through the hoop, and so disengages with ease the train staff. To facilitate this operation by night, a lamp is fixed at the position indicated, the rays being directed away from the approaching train, but towards the hoop upon the staff. The positions of the "setting down" and "pick-up" posts are so determined that the view of the one is not intercepted by that of the other. In the case of the "miniature" train staff, an automatic exchanger, as invented and patented by Mr. Whitaker, Locomotive Engineer of the Somerset and Dorset Joint Railway, is much in request, this appliance being also manufactured by the Railway Signal Company. Its use renders the exchange of staff possible at a speed of 50 miles per hour, or even more. The invention comprises a combined "receiver" and "deliverer" on engine or tender, as also a "deliverer" placed by the side of the rails at the beginning of the single line section, with a "receiver" fixed in like manner at the end. A combined "deliver and receiver" is employed in the case of intermediate crossing stations.

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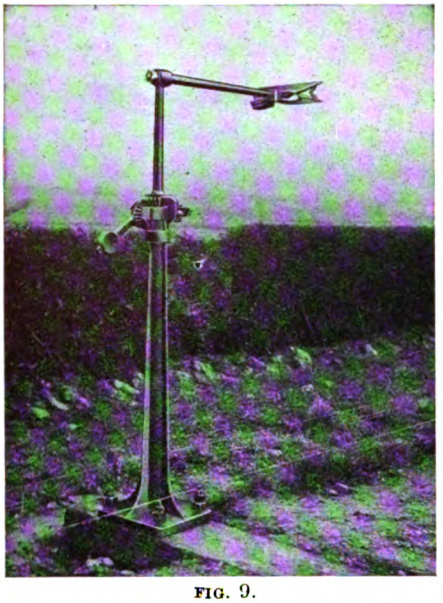

FIG. 9.
Receiver at end of Single Line Section, Normal Position.

The train staff is placed in a leather pouch to which is fitted a steel loop. When it is about to be used, the signalman deposits the staff at the delivering apparatus in the manner shown by Fig. 7, the arm being turned into position at right angles to the rails. The combined apparatus upon the engine consists of a metal jaw of fish-tail type, fitted with three triggers, controlled by light springs. There is also a rubber pad and buffer, against which the staff pouch swings if picked up at speed. At the back of the jaw is a holder, which carries the staff to be given up, a spring clip securing the loop on each side. Fig. 8 illustrates the combined engine apparatus. Immediately after the delivery of the staff the arm, placed (as on Fig. 7) at right angles to the rails, swings back to the normal position, the movement being facilitated by a counter-weighted three-armed lever and other mechanism. The "receiving" apparatus is of the same type, and is illustrated in Fig. 9, while in the case of the combined "receiving" and "delivering" exchange a lower arm is attached, upon which the staff, about to be picked up, is placed. This apparatus is equally suitable for train-tablet operation.

The Warning Signal, or Rule V.

Before dismissing the subject of "Block Telegraph"—under which heading the equivalent system lastly discussed is necessarily included—it is desirable to refer to a modification recognised in certain conditions, and but for which traffic operations at various points would be rendered difficult, if not impracticable. It has been seen that the line, under ordinary block working, must be clear for a quarter-mile beyond the Home Signal before the "Train out of section" signal is sent to the station in the rear, and that the rails must not be again occupied if "Line clear" has been given for a train to approach, unless such train has actually arrived, and been stopped at the Home signal. At certain signal cabins, therefore, such as junctions and specified stations, subject, of course, to gradient or other considerations, a special order of working known as the "Warning Arrangement," is permitted. That is to say, the signalman may accept a train from the rear signal-box, provided the line is clear to the home signal, notwithstanding the fact that the line within that protection may be occupied. When, however, a train is accepted in such conditions, the driver is verbally warned by the signalman at the preceding signal cabin; otherwise "Line clear" is given in the usual manner from the station at which the "warning arrangement" is authorised. This system is extended in some cases where the electric train staff or tablet methods obtain.

The *modus operandi* is as follows:—Whenever, from obstruction or any other cause, it is necessary for a train to be allowed to approach cautiously, the "Is line clear?" signal is not acknowledged in the usual way, but in lieu thereof 13 beats are sent to the signalman in the rear, thus: 3, pause, 5, pause, 5, this signifying "Section clear, but station or junction blocked." When that signal is duly acknowledged, the block indication is, as usual, placed at "Line clear." Upon receipt of this special signal, the signalman brings the train to a standstill at the home signal, and unless a "Calling On" arm be provided, then lowers it to allow the engine-man to draw to his box. He there stops the train by exhibiting a red flag, or red light, as the case may be. The driver is next verbally instructed that the "Section is clear" (to the next home signal), but that the "station" or "junction" ahead is "blocked." A green flag (or lamp) is then exhibited, and the remaining fixed signals lowered. As explained, the "warning arrangement" is used only at places specially authorized, and the fact is recorded in the special block instructions exhibited in the signal boxes concerned.

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THE FIRST PUBLIC TRAIN ON THE UNDERGROUND STARTING FROM BISHOP'S ROAD, JANUARY 10, 1863.
(From the *Illustrated Times.*)

Jubilee of the Metropolitan Railway.

THE first train on the Metropolitan Ra lway was run on January 10, 1863, and the Jubilee of the system was celebrated last month in circumstances more hopeful than any which have existed during the last 50 years. What was in 1863 a tiny railway, 3¾ miles in length, has now developed into a first-class undertaking of 78 miles, reaching far out into the country, and still pushing forth new shoots of vigorous growth.

People then spoke with wonder of "sinking a gigantic brick tube under the earth," and there were those who prophesied that the weight of the traffic above could not fail to cause disastrous collapse, while the inhabitants of the adjoining houses were sure to be "poisoned by the sulphurous exhalations from the fuel with which the boilers were heated." The original line was from Bishop's Road, Paddington, to Farringdon Street. Soon after its opening it secured an average daily traffic of between 35,000 and 40,000 persons, and on the great day of Queen Alexandra's entry into London as Princess of Wales the number rose to the then fabulous height of 60,000. The railway was built on the broad gauge principle, owing to its original association with the Great Western, and subsequent generations of travellers have had cause to bless that circumstance. Broad-gauges meant broad tunnels, and the generous width of the Metropolitan tunnels, especially in the days of steam trains, was an invaluable boon to passengers in respect of ventilation.

In April, 1905, the RAILWAY MAGAZINE contained an "Illustrated Interview" with Mr. A. Charles Ellis, who was then general manager of the line. As therein stated,

"The Great Western Railway subscribed £175,000 of the capital, and appointed four directors, whilst the Eastern Counties and Great Northern Railways were also represented upon the board, and two seats were reserved for the representatives of the London and North Western Railway. The stations were to be half a mile apart, and this proposal has been carried out approximately, save between King's Cross and Farringdon Street, which are about a mile apart, but between these stations provision was made for building, if necessary, an intermediate station at Granville Square, Clerkenwell. Up to the present this station has not been constructed. The trains were to be run in 'rapid succession, and at low rates, to accommodate the endless stream of traffic continually passing between every point on the line of railway.' The absolute block system, *i.e.*, a space interval between trains was promised in the following paragraph: 'As no train will be allowed to start for any station until the departure of the preceding train from that station, no collision will be possible.'

"With regard to the expected traffic, earinngs and expenses, it is interesting to note that trains

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RT. HON. LORD ABERCONWAY, P.C., CHAIRMAN.

were to run every five minutes from 8 a.m. to 10 p.m., with extra trains during the busy hours; or 216 trains each way daily. On the basis of the earnings of the Blackwall Railway, each train was to garner 7s. per mile, or a total 'take' of £604 16s. per day; the receipts on the Sabbath were to be two-thirds of those of each week day, and allowing £45,000 per annum from parcels and goods traffic, the total annual receipts were estimated at £255,258 16s. Actually during the first complete year the line was open (1864) the receipts amounted only to £116,489. The line was to be worked at 35 per cent of the receipts, and the promised surplus of income over expenditure was to pay nearly 12½ per cent. on the capital. . . .

"The capital was soon taken up, and with Mr. J. Fowler as engineer, no time was lost in commencing the construction of the line. To reach, 'the basement of the General Post Office, the railway was laid out to pass under Bartholomew's Hospital, 'but as it was thought that the vibrations from passing trains might interfere with operations and patients,' a deviation was proposed by which the line was to pass under Bartholomew Close instead of Little Britain. To construct the line as originally laid out it would have been necessary to purchase the Cold Bath Fields Prison. The directors sought to avoid this expense, by asking the Prison Commissioners to allow the railway to pass under the prison in a tunnel, but the authorities would not agree to this suggestion, and consequently Parliamentary powers were obtained in 1859 to alter the course of the railway eastward of King's Cross, and to fix the City terminus at Farringdon Street instead of at the General Post Office in St. Martin's le Grand, which was the place authorised by the Act of 1854. . . .

"It was at this time proposed to work the line by means of 'hot water' locomotives, and so avoid steam and smoke in the tunnels. Mr. Fowler got out the drawings for such an engine, but none were constructed, although Mr. (afterwards Sir) D. Gooch, the Locomotive Superintendent of the Great Western Railway, showed such a system was feasible by raising a good head of steam on one of his large engines, then dropping the fire, and running for a distance of nine miles by means of the steam already generated. Fowler next turned his attention to a 'hot brick' locomotive, and an engine on this plan was constructed from his designs by R. Stephenson & Co., at a cost of £4,518. This engine was known as 'Fowler's Ghost,' and she ran a trip down the Great Western Railway on the 10th of October, 1861. The water was heated by means of bricks raised to a white heat, and placed in a chamber within the boiler barrel; the steam thus generated was exhausted into condensing tanks. 'Fowler's Ghost' is described and illustrated in the RAILWAY MAGAZINE for January, 1901, page 63.

"As the Great Western Railway was to work the Metropolitan Railway, it fell to the lot of Daniel Gooch to design suitable locomotives,

MR. R. H. SELBIE, GENERAL MANAGER.

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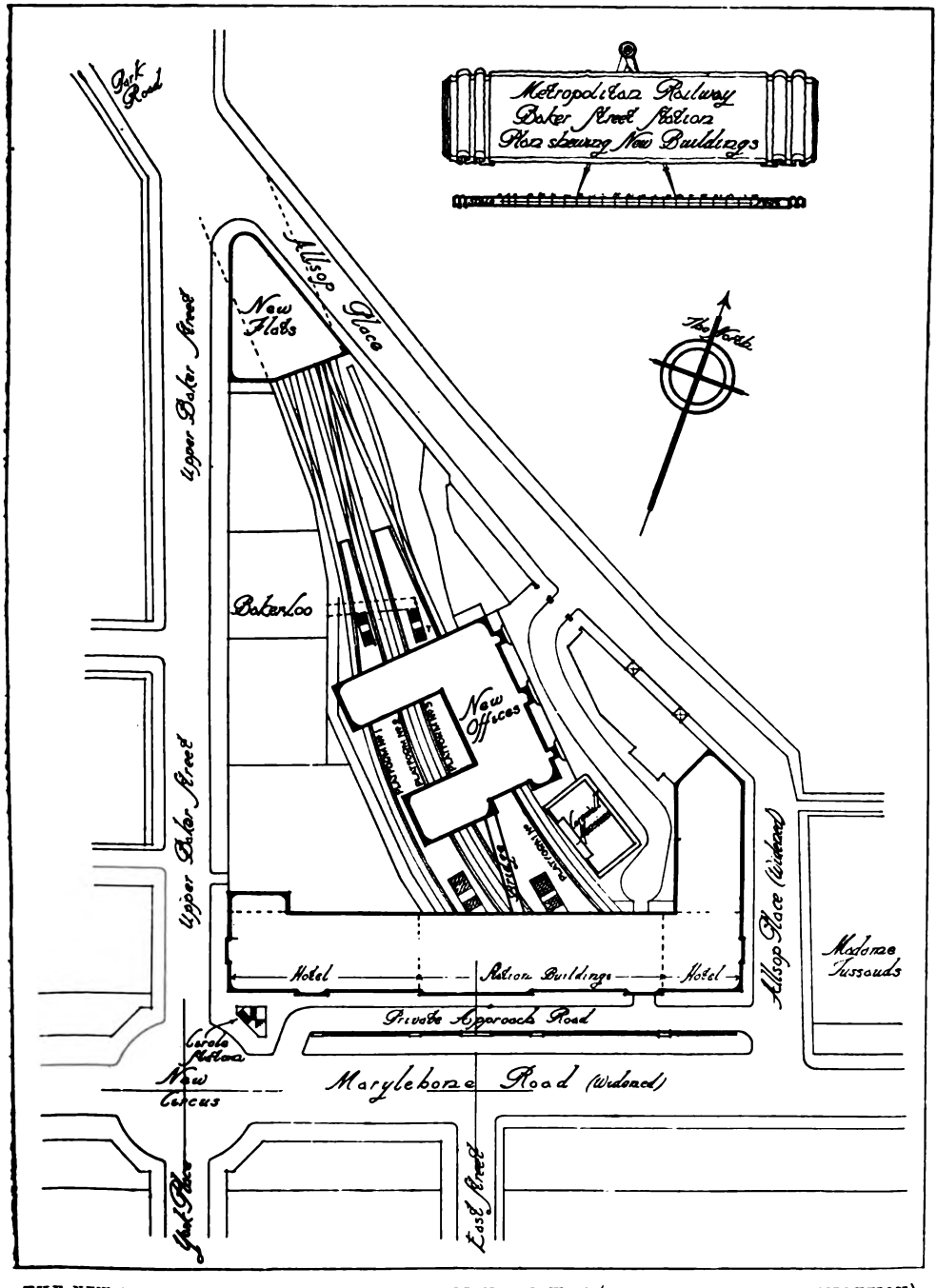

THE NEW BAKER STREET STATION, METROPOLITAN RAILWAY (NOW APPROACHING COMPLETION).

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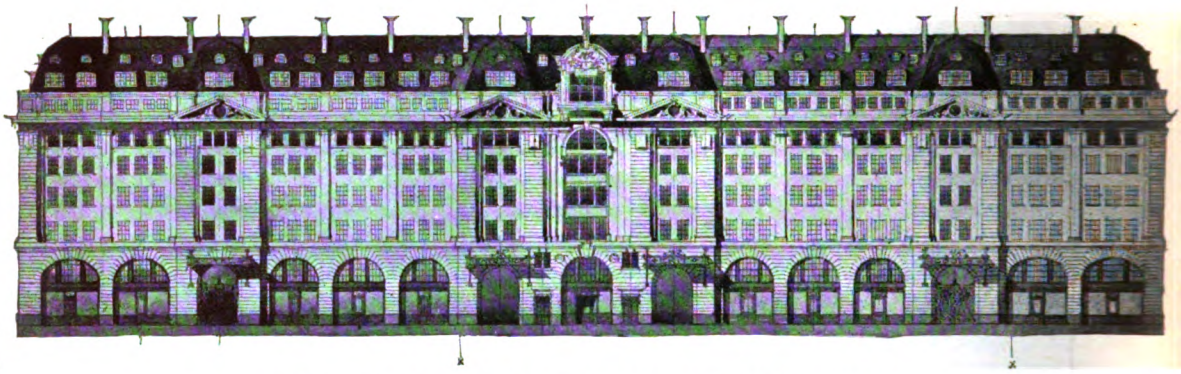

MAIN FRONTAGE OF THE NEW STATION, MARYLEBONE ROAD.

that should comply with the statutory requirements, and emit no vapour or smoke in the tunnels. This he succeeded in doing successfully. The engines were each supported by six wheels. the cylinders were outside, and the driving and trailing wheels, which were of 6 ft. diameter, were coupled, special forms of baffle plate and firebox were employed, the exhaust steam was discharged into tanks under the boiler by means of a reversing valve fitted to the bottom of the blast pipe."

The remarkable growth of the railway is shown by the following official figures relating to capital and receipts from traffic up to June, 1868 :—

		Capital expended.	Traffic for 12 months,
December,	1863 ..	£1,670 340	—
,,	1864 ..	2,369,440	116,448
,,	1865 ..	3,483,860	141,512
,,	1866 ..	4,468,760	210.242
,,	1867 ..	5,731,370	233,180
June,	1868 ..	6,159,690	257,000

Statistics for the year 1865 (when the system consisted of five miles of line in use) are still more striking when compared with those of 1911 :—

	1865.	1911.
Miles open	5	48.
Number of passengers	15,021,000	80,644,000
Goods .. .. Tons	——	913,000
Minerals .. ,,	——	2,132,000
Train miles run ..	367,000	4,311,000
Capital paid up ..	£3,792,000	£23,384,000
Receipts, total ..	141,000	925,000
Expenses ,, ..	56,000	494,000
Net ,, ..	85,000	431,000

Statistics for last year have not yet been completed.

The Metropolitan grew first eastwards towards Moorgate Street, and at a later period westwards towards Kensington. By 1880 Harrow was reached, and in 1884 the Inner Circle was completed by the important extension from Aldgate to Mansion House. But Harrow was only the first big step into the shires, and those who guided the destinies of the railway were soon tempted into the lovely country beyond. From Harrow to Rickmansworth (1887), from Rickmansworth to Chesham (1889), and Aylesbury (1892), the line continued its forward march, and when Sir Edward Watkin became associated with the Company's fortunes even more ambitious schemes began to be cherished.

Through connection to the North was established in 1899, and the main Metropolitan line between Harrow and Quainton Road is now worked by a Joint Committee

NEW FIRST-CLASS CORRIDOR COACH, NOW IN USE ON THE INNER CIRCLE ; METROPOLITAN RAILWAY.

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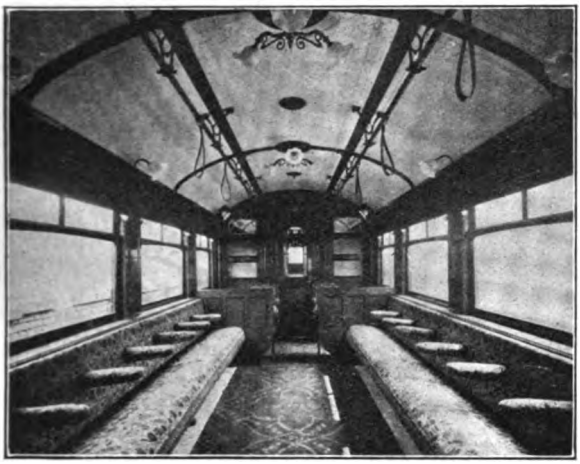
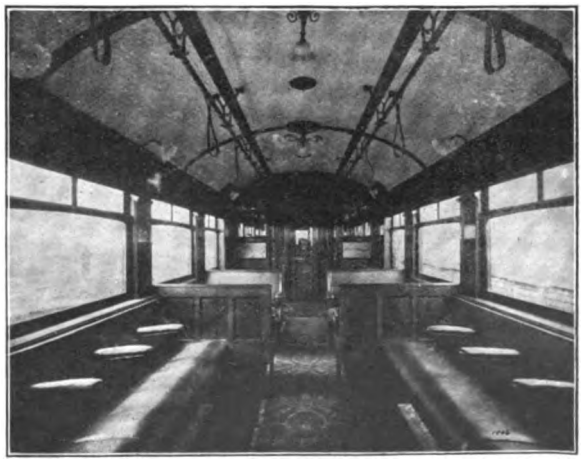


FIRST CLASS COACH: NON-SMOKING COMPARTMENT.

of the Metropolitan and Great Central Railways. But the main purpose the Metropolitan serves, apart from its definite place in the inner ring of London traffic companies, is that of linking city and country. The modern ideal is to work in the City and live out of it—to spend the day at the centre and the night at the extremities. So the perpetual problem of a suburban railway company is how best to get masses of people quickly and punctually from their homes to the City in the morning, and from the City to their homes in the evening. The Company has faced this problem boldly, and never more boldly than when the development of electrical traction in connection with tramways had proved that for comparatively short communications within the London area the change from steam to electricity was absolutely indispensable. Its great power station at Neasden is one of the finest in the country, and will be fully capable of supplying the additional power required for working the Great Northern and City line—soon to pass under Metropolitan control—and also the electric service through Pinner and Northwood by the projected branch to Watford.

Hitherto, the Metropolitan Company have been heavily handicapped—so far as their main line has been concerned—by the fact of there being only a single line connection between the main line metals and those of the Inner Circle at Baker Street. For all practical purposes Baker Street has been a terminus; but the double line of rails between the Company's main line and the Inner Circle, which within the past few weeks has been brought into use, enables the management to run a largely increased service of through trains between their outlying suburbs and the City. Baker Street is thus losing to a large extent its terminal character, and when the alterations there are completed it will be the exception, and not the rule, for any but the purely "shuttle" trains between Baker Street and Willesden to terminate at the former station. The new large signal box just opened, contains an electrically operated illuminated diagram showing the exact position of every train approaching Baker Street from Edgware Road, Portland Road and St. John's Wood Road, thus removing every element of danger from what in the old days would have been an almost impracticable junction.

Nor is it only at Baker Street that lost time will be saved. The line is being widened and additional tracks laid down between Finchley Road and Wembley, the object, of course, being to enable trains to run express from Harrow and beyond to Baker Street and the City, without being hampered by the slow traffic between. This will much accelerate the service from Harrow, Pinner and Northwood, and the electrification over this part of the system will be taken in hand in connection with



FIRST-CLASS COACH: SMOKING COMPARTMENT.

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the new extension to Watford, which is to branch off from the main line between Sandy Lodge and Rickmansworth, just beyond the crossing of the River Gade and the Grand Junction Canal. There will be a station below the rising ground on which Croxley Green is perched, and the line will find its terminus in the rapidly growing town of Watford.

These changes have involved a complete metamorphosis of Baker Street station. A clean sweep is being made of the old cavernous station which has long been out of date. The tunnels have been widened, new road bridges constructed, platforms changed and tracks altered—all without the slightest real inconvenience to the tens of thousands of the public who have used the station daily, and without the derangement of a single train. The new plans provide for a handsome block of station buildings with a 200 ft. frontage on Marylebone Road, with large booking hall, refreshment rooms, cloak rooms and a spacious circulating area, from which broad flights of stairs will lead down to two island platforms 375 ft. long by 35 ft. wide, and four sets of rails. It is also worth mention that escalators will be built from these platforms to lead direct to the platforms of the Bakerloo line, and thus save the present ascent and descent. Over the main platforms of the re-organised station the head offices of the Company will be built, and there will be a large first-class hotel erected on the Marylebone Road frontage.

It is an amazing record considering that from 1863 to the present day the Metropolitan has carried more than 3,500,000,000 passengers; and the wonderful acceleration of the train service, now practically continuous on the busiest section of the line, is only compatible with perfect safety because of the extraordinary improvements in the signalling apparatus and the automatic safety appliances, which help to render it almost impossible for the signalman to make mistakes. On no line, moreover, have passengers gained more in personal comfort from electrification than on the Metropolitan, which, from being one of the most conservative lines is now one of the most ready to experiment in any direction for the increased comfort of its passengers. What the Metropolitan will be "fifty years on" when it celebrates its centenary it would be hard to prophecy. Enough to say that the Jubilee of the Company finds it alert and active, and steadily extending and expanding to the increasing benefit of Greater and ever Greater London.

Accompanying illustrations show the new stock which has been constructed for the company by the Metropolitan Carriage, Wagon & Finance Co., Ltd., and recently placed in service. These new vehicles have been added to meet the requirements of the increased traffic on the Inner Circle, and a number of important improvements are noticeable in design and construction. The cars are of corridor type, with centre gangways, and transverse and longitudinal seats. In addition to the usual sliding door at each end, a double sliding door has been provided in the centre, by means of which a considerable saving of time is effected during the busy hours. Steel underframes are used, and the trucks are of the improved pressed steel type, with rolled disc centre wheels. Teak is employed throughout for the body framing, and the panels of planished steel. At each end the cars are fitted with automatic couplers of the company's standard design.

Following the universal practice of underground lines, there are only two classes—first and third. The cars in each are fitted with partitions and draught screens, and electrically heated. They are also brilliantly illuminated by fittings of handsome design. The non-smoking portion of the first-class cars is upholstered in figured moquette, and the smoking portion in buffalo hide. Third-class cars, smoking and non-smoking, are upholstered also in buffalo hide. In both classes there are thirty-two longitudinal seats and sixteen transverse seats. Inside fascias and panels are of wainscoat oak, French polished. The roofs are of the elliptical type, lofty and expansive, and fitted in the centre with torpedo-type ventilators. In the first-class cars the roof is lined with decorated lincrusta, mounted upon impermeable millboard relieved by suitable teak fascias. This new roof design, with the torpedo-type ventilators, is found to be a great improvement upon the original clerestory roof and its ventilating frames. Comfort of passengers has indeed been carefully studied as regards smooth running, lighting, heating, and ventilation, and the cars are the finest yet seen on the Metropolitan Railway.

Our excellent contemporary *The Railway News* has prepared the following list of the chairmen, general managers, and secretaries who have served the company during the last half century :—

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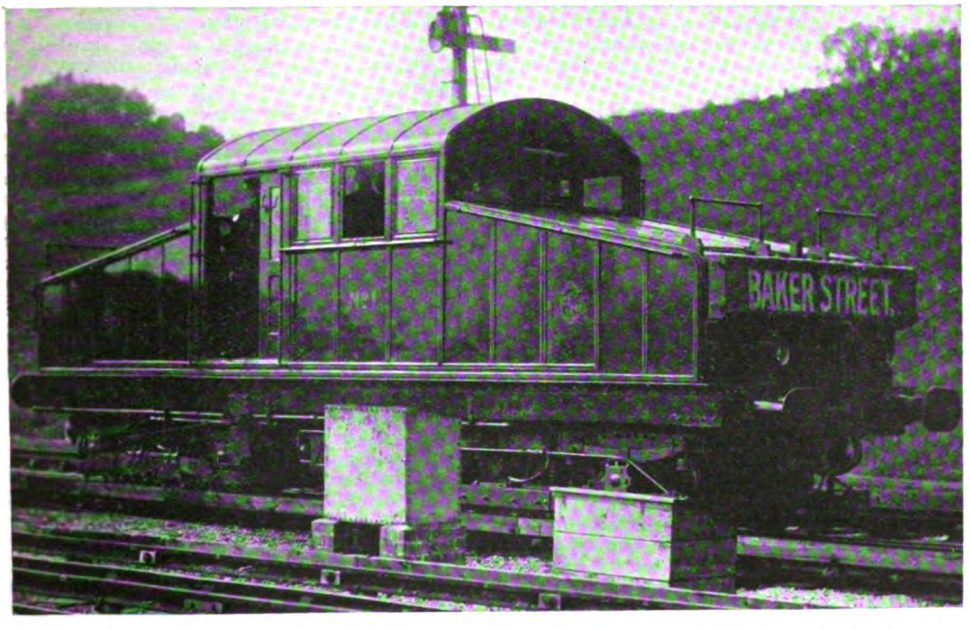
Year.	Chairman.	General Manager.	Secretary.
1853	William Malins.	—	John Henchman.
1856	J. L. Rickards, M.P.	—	—
1858	Wm. A. Wilkinson.	—	—
1862	—	Myles Fenton.	—
1865	John Parson.	—	—
1872	Sir Edw. Watkin.	—	John Bell.
1880	—	John Bell.	J. M. Eyles.
1889	—	—	G. H Whissell
1894	John Bell.	—	—
1901	J. J. Mellor.	A. C. Ellis	—
1903	—	—	R. H Selbie.
1904	Sir C. M'Laren (now Lord Aberconway).	—	—
1908	—	R. H. Selbie.	W. H. Brown.
1913	Lord Aberconway.	R. H. Selbie.	W. H. Brown.

It will thus be seen that the Metropolitan has had eight chairmen, four general managers, and six secretaries. The present Chairman of the board, Lord Aberconway, formerly a popular member of the House of Commons, has well maintained the famous records left by his predecessors, while Mr. Selbie, the General Manager and formerly Secretary, is to be personally credited with much of the enterprise which is seen in the general policy pursued and in every department of control.



Photo] [*R. W. King.*

METROPOLITAN RAILWAY ELECTRIC LOCOMOTIVE NO. 1.

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PERTINENT PARAGRAPHS

Railway Nationalisation.

THE articles on this subject, from the pen of a well known British railway official, published in the RAILWAY MAGAZINE (November and December, 1912), have attracted considerable attention, and we are indebted to Mr. H. Künkele, an old reader resident in Frankfort, for the following contribution :—

"With great interest I have read your last article about the nationalisation of railways, and, far from venturing to advocate this for England, I wish to draw your attention to the fact that this article shows again how difficult it is to compare institutions of different countries without injustice. There can be no doubt that for our country (Germany) State railways are an absolute success—financially as well as for the general public—besides the advantages for mobilisation. It is not difficult to prove that progress is not an unknown feature for a well-directed State enterprise: see the Prussian State Railway and superheating, the attention given to new inventions and improvements, etc. If one considers that by far the most passengers in our country travel in fourth-class (at the rate of 0.4d. a mile), that for comparison with third-class in England one should always take second-class in Germany (and not third-class, as this is far cheaper than third-class in England), perhaps the result is more in favour of our country. To show this, please look at the enclosed statement (not reproduced.—ED.), wherefrom you will see that at the rate of about one penny (or even less) a mile you can travel in up-to-date corridor expresses with dining (or first *and second-class* sleeping) cars and in second-class compartments superior to the English third-class, and seating only 6 (not 8) passengers, besides the advantage of the greater part of the public travelling in a lower class. You will also see that there are frequent and fast connections for greater distances.

"Now to the reproach of there being no cheap excursions or pleasure trips, etc. In this country Saturday is not a half-holiday, and in most towns the shops are open even on Sundays for 3 to 4 hours, so 'week-end holidays' are absolutely unknown. Here people have only time for excursions on Sundays and they can obtain cheap Sunday-tickets. For instance, from Frankfort these tickets are issued every Sunday to over 70 different places of interest, and in many cases also allow to return from another place. I may mention the following places known to Englishmen :

SUNDAY TICKET FRANKFORT TO

	2nd.-class. s. d.	3rd.-class. s. d.	Miles.
Wiesbaden ..	2 10	1 9	59
Heidelberg ..	5 10	3 8	110
Homburg ..	1 3½	0 10	24

Similar tickets are also issued at most stations (for instance, from Darmstadt to 27 places, from Mayence to 40 places, etc.). In Berlin similar tickets are the 'Vorort tickets' (second-class at 0.42d., third-class at 0.28d. a mile). Of course, there are also cheap excursions arranged for visiting exhibitions and the like; even the Royal Saxon Opera at Dresden, together with the Prussian and Saxon State Railways, arrange cheap trains (ticket includes also a seat in the opera) with dining-cars from Berlin to Dresden and back same evening for the first performances of famous operas. Touring-clubs provide also cheap special trains: these are published in the local papers and everybody can use them (not only club-members). Further 'Ferien-Sonderzüge' tickets are issued at reduced prices for Christmas, Easter, Whitsuntide, etc."

* * *

New Pullman Cars on the South Eastern and Chatham Railway.

THREE new Pullman cars were, in December last, put into service on the South Eastern and Chatham Railway. They are the buffet car "Seville," and the parlour cars "Alicante" and "Leghorn." All are engaged in the extremely popular 11 a.m. service from Victoria to Paris *viâ* Dover and Calais. Entirely of British manufacture—having been built at the works of Messrs. Cravens, Limited, Sheffield—they resemble in general design those previously introduced upon the same system. The dimensions are as follow :—

Length over vestibules	59 ft. 0 in.
Length over platforms	57 ft. 6 in.
Centres of bogies apart	39 ft. 9 in.
Wheel base of bogies	8 ft. 0 in.
Extreme width of car	8 ft. 6 in.
Height from rail to top of roof ..	12 ft. 6¾ in.

Constructional framework is carried out on Pullman lines, specially selected timber being employed throughout. Entrance vestibules, corridors and lavatories are panelled in mahogany, and the floors of the same are covered with interlocking black and white rubber tiling. The lavatories are supplied with hot and cold water service, dressing table, and all other necessary fittings. Laycock's patent combined arrangement of centre coupler and adjustable side buffers, and compensated Pullman vestibules are again used, so that it is possible for the cars to couple up with other stock fitted with either automatic centre couplings or ordinary drawgear and side buffers. Heating has been specially arranged so that sections may be cut out to suit the requirements of passengers, the system used being Laycock's improved steam heating. The brake is of the vacuum type. A complete equipment of electric bells is provided, in order that passengers

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may readily communicate with the attendants from any portion of the cars. Ventilation is effectually carried out by Laycock's latest design of torpedo air extractors, in addition to which the large compartments are provided with electric ceiling fans, punkah type, with a special reversing arrangement to ensure a constant circulation of fresh air. The buffet car "Seville" is decorated in fine mahogany, with panels of curl veneer, enriched by shaded inlays in the Georgian style, the principal motifs being floral festoons oval in form. Fitted with plate glass tops, the tables are of the same wood as the panelling, and a patent extension movement permits of the size being increased when desired. Mahogany chairs are upholstered in a rich tone of green leather, and the floor is covered with a deep pile green carpet. A conspicuous feature in this handsome saloon is the bow front show cabinet, appropriately surmounted by a clock. The car is seated for 19 passengers, all enjoying equal comfort in arm chairs. In the parlour car "Alicante," panelled in pear tree with holly inlays, Louis XV. is the style of decoration adopted, and in this instance the panel design is taken to its full height. Here the chairs are covered in fine blue velours, and the carpets have harmonious colouring. In the parlour car "Leghorn"—which, like the "Alicante," seats 24 passengers—grey sycamore appears in the panelling, inlaid with richly shaded white wood. The style is of the Louis XVI. period, and is truly described as the essence of refinement. Ceilings, electric fittings, and tables are executed and finished in the same generous manner as in the other cars; the chairs are upholstered in a beautiful tone of crimson velvet of Louis XVI. design, and the carpet corresponds in tone. Interior decoration of all the cars has been supplied by Messrs. W. S. Laycock, Limited, of Sheffield, and the work was carried out under the supervision of Mr. Thomas Powell, Secretary and Manager of the Pullman Company, Limited, to the approval of Mr. H. S. Wainwright, Locomotive and Carriage Engineer of the South Eastern and Chatham Railway.

* * *

Bombay, Baroda and Central India Express.

In the last issue of the Railway Magazine, a photograph was published showing the express train now running every Friday between Bombay and Delhi, on the Bombay, Baroda and Central India Railway, in connection with the P. & O. mail steamers from India. The distance covered by rail is 862 miles, and the journey is completed in 24½ hours, or four hours less than the time taken by the special postal express conveying the British mails from Bombay to the new capital by the Great Indian Peninsula Railway. The Bombay and Baroda express, timed to start from the Colaba terminus at 12 noon on the day the mail steamers arrive, is corridor throughout, and composed of the following vehicles:—Two first-class corridor carriages running on six-wheeled bogie trucks, one restaurant car, and one third-class with luggage van and guard's compartment, running on four-wheeled bogie trucks. An extra first-class corridor carriage is attached when necessary. Mounted on 62 ft. underframes, the coaches are all 64 ft. long and 10 ft. wide over the bodies, the total length over buffers being 66 ft. 2 in. In each of the first-class corridor carriages accommodation is provided for 16 passengers, two double compartments to sleep 4, and four coupés to sleep 2 (two of the coupés being reserved for ladies). Two spacious bathrooms, with white enamelled baths and basins are fitted in each of these coaches (one for the use of ladies and the other for gentlemen), and there are two lavatories. In each of the double compartments there is a wash-hand basin, with folding teak cover, which forms a small table when the basin is not in use. The best quality of leather of a dark green colour has been used in upholstering the seats, and the floors of the carriages are covered with cork linoleum. Ceilings are covered with lincrusta of an artistic pattern, painted white and picked out in gold. All the interior woodwork employed for the decoration of the carriages is of the best selected polished teak. The restaurant car, carefully designed to ensure comfortable running, consists of one main dining compartment, with 8 tables seating 32 passengers. Electric fans are erected over each table, and handsome electroliers fitted in the roof supply ample light. Gas is required for cooking purposes. Incandescent lights are also arranged in the dining compartment. Fourteen feet long, the kitchen is equipped with the most up-to-date type of gas cooking range and every other convenience necessary for providing a first-class cuisine. Beyond the kitchen is a small compartment, containing a lavatory basin, etc., for the use of the dining car attendants and servants. Another compartment is also provided for the dining car manager. There is a bar fitted with ice boxes and other necessary fittings, and the total weight of this vehicle in running order is 43 tons. In the third-class carriage there are eight transverse compartments, with a gangway giving access to the lavatory. Each compartment is provided with a door on either side of the carriage. Outside all the carriages are painted pale cream, with dark olive green mouldings. Panelling below the waist belt is composed of teak match boards, and the top panels are of steel sheets. The underframes and bodies, designed and constructed in the Company's works at Parel, afford the highest degree of comfort to passengers as regards smooth and comfortable running. From Bombay to Baroda the train is worked by one of the Company's 4-4 0 express passenger engines, and onwards by one of the 4-6-0 heavy express passenger engines.

* * *

The West Highland Service.

A Scottish correspondent writes:—"Since the beginning of November last, the 4.47 p.m. train from Glasgow (Queen Street High Level) to Fort William has left at 5.12 p.m., and been accelerated by running non-stop to Craigendoran, the former calls at Cowlairs and Dumbarton being discontinued. Crianlarich is accordingly reached only four minutes later than previously, namely, 7.17 p.m.—and the alteration has the effect of giving the connection off the 6.15 p.m. Caledonian train from Callander daily now, instead of Thursdays only, as before. Although the convenience is primarily intended for passengers from the Callander and Oban line

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east of Killin Junction going north of Crianlarich by the West Highland, it also enables passengers from Glasgow to Oban—or any station on the Callander and Oban west of Crianlarich—to travel North British on the first stage of the journey to the latter point. By so doing one need not leave Queen Street Station until 27 minutes after the departure of the Caledonian train from Buchanan Street. The necessity of changing stations at Crianlarich, and the fact that the connection is not shown (though there is a nine-minute interval between the two trains) will not, however, induce many travellers to take advantage of it. As one who takes a particular interest in everything pertaining to the West Highland, I should like to say here how much I regret seeing summer after summer pass without any attempt being made to foster interchange of traffic between the two systems at Crianlarich. The spur line connecting them is seldom used, although it might be worked to great advantage. If the days of petty jealousies are past, surely some scheme could be formulated which would not only prove of immense value to the tourist (on whom both lines are dependent for the greater amount of passenger traffic) but to the mutual benefit of the Companies concerned." Another reader, writing in reference to the same trains, writes as follows: "I understand that the reason why the 4.47 p.m. Perth train now starts 2 min. later is that since November 1 it has been run entirely independently of the 4.47 p.m. Fort William train. Formerly the Fort William and Perth trains ascended the incline together, with the latter portion in front. The train was divided at Cowlairs and the Perth portion left immediately, after which the Fort William engine backed on to what was left and went off after connecting with the 4 p.m. express from Edinburgh, which stopped at Cowlairs for that purpose. Since November 1, however, the Edinburgh train has come right down to Queen Street, as stated by you, still, however, connecting with the Fort William train, which does not now leave until 5.12 p.m."

* * *

Engine-drivers in Difficulties.

Some people think that the sole duty of a locomotive engine-driver is to work certain handles so as to cause his engine to start, stop, go faster or go slower, while of course, watching the signals and otherwise keeping a good look out. Superficially, this may be so, for an express driver does not fuss about the footplate, getting in the fireman's way, and otherwise giving an impression of being very busy and having great responsibility upon his shoulders. Indeed, the driver who apparently takes things most easily is often the one who is best able to deal with an emergency. An observer on the footplate, unless a practical man himself, can rarely realise that anything is wrong, so nonchalantly do the enginemen go about their work, doing this or that to compensate for the faulty action of one of the appliances or to overcome a failure which has suddenly manifested itself. And in more cases than is generally realised the enginemen have saved a situation in such a matter of fact fashion that only the locomotive officials are aware that anything has gone wrong. Indeed, the suggestion of responsibility for successful railway working is perhaps more strikingly exemplified on the footplate than elsewhere. An injector fails to work properly, one of the axle boxes runs hot, a brick-arch falls in, a lubricator gives out, the regulator does not operate as it should or the valve becomes disconnected. Some failures render further train working impossible; but in these minor troubles the driver usually keeps going, sometimes completing his day's work, notwithstanding that his engine is operating under difficulties. Enthusiasm is shown equally by firemen, and an American contemporary records a case in which on a locomotive hauling an important passenger train the compressed air apparatus opening the fire-box doors became out of order so that fuel could only be passed through one of the firedoors, and rendering it impossible to use the shovel. By the ingenuity of firemen and engineer the locomotive was fired by hand in this way, and the train arrived on schedule time at the terminal, enabling the division to retain a perfect record.

* * *

London and the Riviera in Winter.

We have received the following letter from Mr. H. P. Hart, of Corpus Christi College, Cambridge:—"I should like to take exception to Mr. Aflalo's statements regarding the English climate in winter in his article, 'By Mediterranean Express,' in the January number of the Railway Magazine. One would think to read his article that there is no such thing as daylight in London at this time of the year. Has Mr. Aflalo ever stood on Waterloo Bridge towards the close of a January afternoon, on one of those days when the sun has been shining brightly and there is a touch of frost in the air, which seems to make life worth living? The sun is going down in a blaze of glory. London looks like an enchanted city. There is a golden mist, transforming even the most commonplace objects, Mr. Aflalo would call it musk. The sun has caught St. Paul's and the surrounding spires and turned them into gold. The scene is one of indescribable beauty. I have watched it many times. This is the city which Mr. Aflalo calls 'the Pit.' Does he really mean that? Either he does not know London, or else his eyes are blind to its charms. He has not experienced its hue. Of course, he will say that for one day like this there are ten in which there is a dense fog, or it is raining or doing something unpleasant. No doubt there are days on which it is preferable to remain within doors, but they are by no means in the majority. I have spent a good deal of time in London, but I do not wake up in the morning 'coughing with lungs full of fog, and blinking through eyes that smart with smoke.' I object to London being called 'a city of the wintry night.' It is *not* so. The Riviera is all very well for invalids and the aged, but to rush off there at the first touch of winter in the air is to use Mr. Aflalo's words, 'a sheepish, follow-my-leader game of society.' The English climate is not a justification for this. There are places in South Devon and Cornwall where the most susceptible to cold would not suffer, and where, moreover, there is no mistral. The article in question was very interesting, but it was unnecessary to cast quite undeserved aspersions on the English climate. To call London 'the Pit,' was nothing short of insulting.

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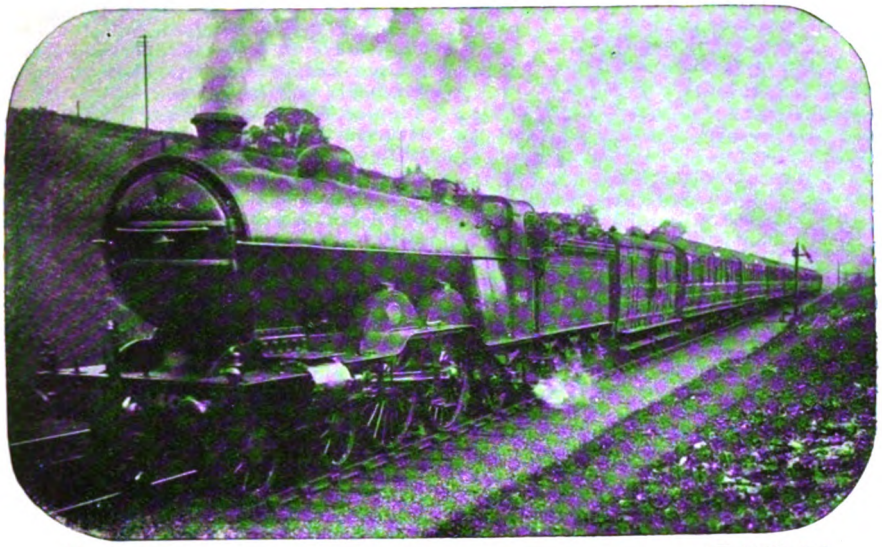

Photo] [*H. T. Worlock.*

GREAT NORTHERN RAILWAY:
1.40 p.m. down Express, near Potters Bar. Locomotive No. 1400.

Mr. Aflalo acknowledges that home to him at this time of the year is anything but sweet. His affection for home is rather curious. He may go off to the Riviera, while I, for my part, will remain at home 'shivering over the fire."

* * *

Remarkable Railway Runs.

A CORRESPONDENT engaged on the Canadian Pacific Railway, writing on the 19th October last, says:—"There are surely several points to be cleared up regarding the very *remarkable* run between Exeter and London, Great Western Railway, recorded by one of your readers, and shown on page 341 of the October (1912) RAILWAY MAGAZINE. In the first place, it seems somewhat out of the common run of timing experience that each station should have been passed exactly to the minute. Secondly the fairly important times for passing Whiteball Summit, Castle Cary, M.P. 108¼ (122¾) and Westbury are not given at all. Thirdly, even expert timers have to keep quite alive with good stop-watches to catch speeds of over 75 miles per hour. Yet here is a gentleman who does not appear to use a stop-watch at all 'estimating' the speed down Wellington Bank at 88 miles per hour, a speed rarely registered, in print at any rate, by well-known timers like Mr. C. J. Allen. Fourthly, the speed between Newbury and Thatcham works out at 105 miles per hour, which is surely a record!!! Other things in connection with the run might be pointed out but I think these four will suffice, merely mentioning that the Taunton passing time with such a huge load is rather inconsistent as compared with the sluggish work between Edington and Savernake; but perhaps the Edington passing time is a few minutes out. I will close by wishing you the best of luck, and saying that I consider after 11 years reading that you are still the best and leading Railway Magazine."

* * *

Railway Engineering in Belgium.

A BRUSSELS correspondent writes: "Railway engineering is one of the most prosperous undertakings in Belgium. There are nearly 20 large works building locomotives, double that number erecting railway carriages, and double again making goods wagons. Their annual output is about 1,000 locomotives, 8,000 passenger cars and 25,000 wagons, and the export of railway stock is about £8,000,000. Belgian capitalists have invested something over £30,000,000 in Russia, there being over 100 big trading concerns. Half of them are interested in coal and iron mines, petroleum wells, metal and glass works, while about 20 companies are running trams in Russian cities. A £10,000,000 railway scheme in China is another notable enterprise, and the Congo has a great future for railways. Their State railways afford another proof of their enterprise, these having been the first adopted on the Continent. You may travel anywhere on their 3,000 miles of track for about half-a-sovereign for five days. Steamer services are excellent, and the Belgian line affords one of the best routes to the Continent. The International Exhibition at Ghent will be a unique chance next summer to see all the leading industries represented, Belgium is making a supreme effort to bring her many industries to the fore. The field is a very wide one—railway and colonial enterprises, coal mines, iron works, copper mines, stone quarrying, blast furnaces, steel works, glass blowing, zinc works, plate glass manufactures, sugar refineries, rails and rolling stock. Besides all these, Ghent will show a marvellous field of activity in the textile trades, being noted for cotton, lace, linen and silk goods of all kinds, while the horticultural and agricultural

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displays will be combined with all the latest novelties in sport and amusements."

* * *

Archaic Views of Locomotive Engineering Problems.

A CONTEMPORARY recently published the following ingenious suggestion:—"The difficulty of designing an express locomotive nowadays is, I believe, to get a sufficiently large boiler on top of the driving wheels. Could not this difficulty be obviated by designing an engine in the following manner? The locomotive would consist of two cars or trucks. On the front one would be the cylinders, but no boiler. In order to increase adhesion, a large amount of coal might be carried above the cylinders. The rear car would carry the boiler, which might be of a diameter limited only by the loading gauge. The firebox would be at the front part of the boiler, the smokebox being, of course, at the back. The steam-pipe would be flexible metallic tubing. The advantage of such a locomotive would be that large drivers and powerful cylinders could be used; also the boiler could be made with a large heating surface. One disadvantage is that there would not be much weight available for adhesion, but surely this might be obviated by carrying a large supply of coal and water, or even by loading with scrap iron, etc." It is difficult to understand how such a proposal could nowadays be seriously made, especially as engineers do not desire to carry scrap iron or unnecessary supplies of coal and water about merely to obtain adequate adhesion weight. Indeed, the idea savours of early days in locomotive development, when many strange recommendations were put forward, and in some cases experimentally adopted. The *Hurricane* and the *Thunderer*, constructed for the Great Western Company, both included the separate engine truck, but neither proved in any way satisfactory. In America the Philadelphia and Reading Railway had an engine, the *Novelty*, which was constructed about 1846 in the same style. Like its English prototypes, it was a complete failure.

* * *

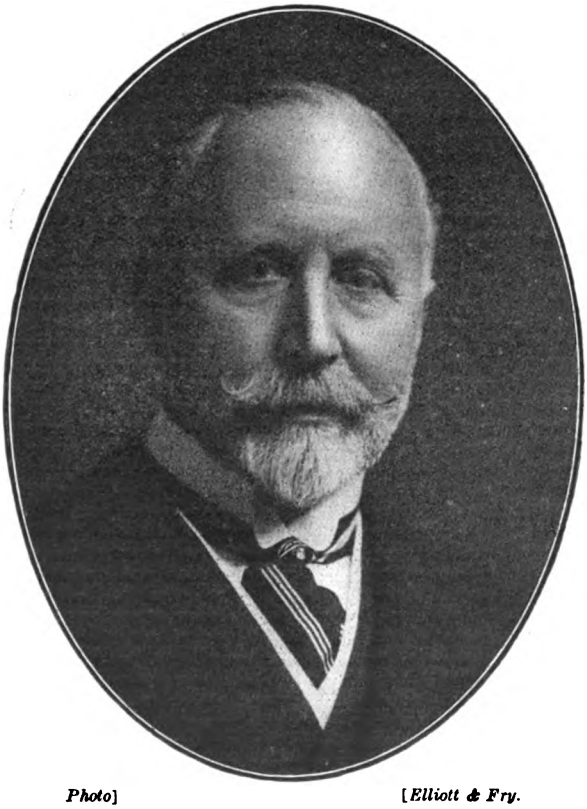
Queensland Government Railways.

THE Queensland Government is vigorously carrying out its policy of railway extension. As is well known, £10,000,000 is to be spent, of which about one-fifth has up to the present been borrowed. Last year the total value of the work of the Indent Department of the Agent-General's office was about £980,000, including £373,721 for rails and fishplates. Sir Thomas Robinson, Agent-General, in his annual report to the State Parliament, says that, in addition to this material, "large quantities of materials were bought in the State through various merchants for Government contracts, but subject to my supervision and inspection during manufacture and shipment, among which the following may be mentioned:—Material for 50 locomotives, Class C16, for railway department; 650 miles galvanised wire netting for Department of Public Lands; 14 miles steel piping, consisting of plates, locking bars and joint rings, for the Metropolitan Water and Sewerage Board; 3,600 pairs of wheels on axles for railway department; 890 tons of steel wire for railway department; material for 12 30,000-gallon wrought-iron water tanks for railway department; 460 tons barbed wire for railway department; material for bridges over Park Road, Fairfield Deviation, Mooloolah river, and Reid's Creek railway department; 3,004 tons of rails and fastenings for Aramac Local Authorities; material for bridges over Crescent Road, and Black river, railway department; bridges over South Brisbane line, Ipswich, Logan, and Cleveland roads, railway department—of a total estimated value of £180,000." During the year the Agent-General also sent out 1,817 railway labourers to carry on the work of railway construction.

* * *

New Year Railway Honours.

THE New Year honours included knighthoods for two men holding high positions in the railway world—the General Manager of the London and North Western Company, and the chief inspecting officer of railways under the Board of Trade. Sir Frank Ree, who was educated in France, Germany and Switzerland, has been connected with the London and North Western Railway since October, 1873. His business career began with Messrs. Lebeau, Continental carriers, whom he left to join the staff at the London



Photo] [*Elliott & Fry.*

SIR FRANK REE,
General Manager, London & North Western Railway.

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and North Western Broad Street goods depôt. Having afterwards had four years' experience in the Continental offices of the Company, he was, in 1878, appointed assistant to the London Traffic Superintendent. His next change was as assistant to the district manager in Liverpool, and in 1885 he took control of that district. In June, 1893, he succeeded Mr. Frederick Harrison as Chief Goods Manager at Euston, and in June, 1899, followed him as General Manager. Sir Frank Ree takes the keenest interest in the widespread work of the Company, and offers active encouragement to all its social and educational agencies. Lieut.-Colonel Sir Horatio Yorke, a retired officer of the Royal Engineers, who was born in 1848, has for 12 years held his present office at the Board of Trade. He is acknowledged to be one of the ablest and most conscientious railway inspectors who ever served that department.

* * *

"Old Tityos."

THE *Warminster Herald* of July, 1858, chronicles the fact that "Passengers by the mid-day train to Devizes were not a little alarmed on Saturday last by the sudden stoppage of the engine and carriages near the New Prison. Upon discovering the cause of the standstill, which was owing to the breakage of a portion of the machinery of old 'Tityos,' they were only too glad to get safely out and walk the rest of the journey to Devizes, which, luckily, was not far. To add to the misfortune the turntable, over which all the up trains run as they pass into the station, broke down during the same morning, and up trains were consequently obliged to run past upon the side line and back to the platform, and get out by the same means." Seeing that "Tityos" was one of the first 6-coupled engines ever used by the Great Western Railway, being built by Nasmyth in 1842, the above appellation was apparently justified. She had a domed firebox and 16 in. cylinders. The coupled wheels were of 5 ft. diameter. "Tityos" was one of the few examples of B.G. goods engines having outside frames and bearings, all succeeding locomotives of this type being of the "inside" order. The "new prison" alluded to is that which at the period superseded the old County Gaol, formerly located at Salisbury.

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West of England Train Services.

WE have received a letter from a reader at Axminster, Devon, complaining that the winter service of the London and South Western Company to the West of England is "unsatisfactory and disappointing." It seems to us, however, that the writer supplies a complete answer to his own communication when he says "I am all against wasteful running of superfluous expresses during the dead months." Statistics have conclusively proved that the services which were provided to the West of England prior to the coal strike of 1911 were much greater than the traffic warranted, and even with the curtailed service now in operation many of the trains are very poorly loaded. The process of running trains at a financial loss may afford convenience to the travelling public, but, from the point of view of the railways, it obviously cannot be continued indefinitely.

MR. W. WHITTLE.

Metropolitan District Railway.

FOR 42 years, during the last 8½ years of which he has held the office of Chief Accountant, Mr. William Whittle has been connected with the working of the Metropolitan District Railway. Knowing it in evil days, he remained to see it placed on a much more secure financial footing than it has ever had in the past, and, at the close of the year 1912, when the fruits of endeavour were apparent, he retired. The directors and officers thought that some mark of the esteem and respect in which he was held should be paid, and at a farewell dinner he was the recipient of a handsome service of silver plate. Lord George Hamilton, the Chairman of the Company, presided, and there were also present Mr. Murray Griffiths and Mr. Ernest Law (Directors), together with Mr. Albert H. Stanley (Managing Director) and other officers of the Company. The Chairman and Managing Director referred to the distinguished and faithful service which Mr. Whittle had rendered to the Company and to the intimate knowledge which he had of the complex arrangements that had from time to time affected its fortune. A further presentation to Mr. Whittle was later made by members of the staff and friends. This took the shape of an illuminated address and a gold watch, which were presented by Mr. Comerford (Chief Assistant to the Accountant). On each occasion Mr. Whittle expressed grateful appreciation of the compliment paid to him.

* * *

New Assistant General Manager, North British Railway.

No railway appointment dating from the beginning of the present year has been more cordially welcomed than that of Mr. James Calder as Assistant Manager of the North British Railway. For nine years Mr. Calder has been the confidential and trusted chief assistant to the General Manager, and now the directors have

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recognised his sterling worth by giving him a status which we are surprised is not more generally created throughout the country. Mr. Calder had the distinction of being actually born on the company's property, namely, at Blackhall railway station, on June 15th, 1869. Having been educated at Shotts and Hamilton, he began his career with the North British Railway in April, 1883, and, having obtained four years' experience at Peacock Cross, Lennoxtown and Craigondoran stations, was transferred to the office of the District Superintendent, Glasgow, where he was employed for a period of five years prior to receiving a position in the department of the General Manager. Subsequent promotion resulted in his being appointed chief assistant to the General Manager, and this office he has held since November 1st, 1903. Mr. Calder assumed his new authority on January 1st, with the good wishes of all who knew him.

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Railway Construction in Russia.

THE following railway works were undertaken in Russia by the State and in progress during the year 1912:—Rebuilding certain portions of the Trans-Siberian Railway.—The sum of £600,000 was assigned for the purpose, and the work (total cost now put at £7,700,000) is nearing completion. Duplicating the track of the Trans-Siberian Railway.—The total cost is estimated at £8,900,000. Up to the end of 1911 £4,400,000 had been assigned and £2,200,000 was assigned in 1912. Tumen-Omsk Railway.—The estimated cost is £3,300,000, of which £2,700,000 had been assigned up to the end of 1912. Amur Railway.—The estimated cost is £22,900,000, of which £14,200,000 has already been assigned. Connection between Russian and Finnish Railway system.—Estimated total cost £900,000, of which £800,000 has been assigned. Other works in progress are:—Connection between Yaroslav Junction and the bridge across the Volga. Kars-Saryhamyshino Railway, etc.—The total estimate for new construction work on State Railways in 1912 was £12,300,000.

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Cost of Running a Railway Station.

To give some idea of the cost to the railways, even of running a small station, an official table is submitted in a book just published by John Murray (6s. net). The authors are Mr. Charles Watney and Mr. James A. Little, and the work is entitled "Industrial Warfare." A typical station is taken at a place with about 6,000 inhabitants, where both passenger and goods traffic is dealt with, and the cost of running the same is about £4,000 per annum. The first outlay on the passenger station was £8,000 and on the goods depôt £3,000, the interest on the total sum at 5 per cent. being equal to £550. Salaries in 1911 of the stationmaster, booking and parcels clerks (3) were £450; the wages of the foreman, ticket-collector, and porters (12), £700; and of the signalmen (3), £180; salaries of the goods clerks (5) were £480, and the wages of the goods porters (6), £310; while the cost of the carting staff, draymen (6), horses, provender, etc., was £700. Stores, lighting, and water cost £430, rates and taxes £120, and the maintenance of the station buildings £280.

Too Big for the Loading Gauge in America.

SOME people imagine that American railways are free from loading gauge limitations. In reality, however, there are restrictions as regards weights and dimensions, but the limits are so much easier than our own that the American locomotive engineer is relatively free to increase dimensions as he may desire. That limitations do apply is clearly shown by some enormous 2-8-8-0 locomotives recently constructed by the Baldwin Works for the Great Northern Railway, U.S.A. In these engines the boiler is of taper design, 7 ft. 6 in. being the *smallest* diameter, increasing to 8 ft. 6 in. where it joins the huge Belpaire firebox. The steam dome is formed of a single piece of flanged steel 33 in. diameter, but only 10½ in. high. Moreover, the safety valves and whistle are mounted on a steel casting *depressed* in a circular opening cut into the boiler behind the dome. As the sand boxes could not be placed on top of the boiler, they are arranged in front of the engine, while the bell is on the left-hand side on the round of the boiler.

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South Eastern and Chatham Employés Discuss Railway Matters.

A MOVEMENT of peculiar value to the employés of traffic departments has been inaugurated on the South Eastern and Chatham Railway. In November last, with the approval of Mr. Francis H. Dent, the General Manager, it was decided to hold a series of meetings at Margate West, Red Hill, Dorking, and other stations for the discussion of certain subjects interesting to railway men. The experiment has, we are glad to learn, been attended with great success, there being a good attendance at all the meetings, all grades evincing keen concern in the proceedings. Another practical educational agency has been established on the same system by the formation of a Research Association in connection with the Superintendent and district Superintendents' offices, and a large number of the clerks in the traffic department regularly attend to discuss matters relating to various phases of railway work.

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A Driver who learnt to read and write to save his ob.

AN American contemporary mentions a case in which a certain railway having instituted an inspection of all the trainmen for the de ection of colour-blindness, found that one of the oldest passenger engineers could not read or write. The result was that the man was at once taken off the road, and notified that he could have a switch engine to run. Instead of accepting this oblique promotion, he asked and received leave of absence for three months. Then he went home, got the assistance of a teacher, and began labouring to acquire a knowledge of reading and writing. This was done so vigorously that at the expiration of his leave he wrote a very respectably penned letter to the master mechanic intimating that he was ready to take his engine, and was re-established.

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Mr. C. J. Bowen Cooke, Chief Mechanical Engineer, London and North Western Railway, read an exceedingly instructive paper before the members of the Institution of Civil Engineers. He pointed out that owing to the growth of traffic and the heavier loads which have to be hauled at the present time, it has been found expedient to adopt, at the extensive running-shed of the London and North Western Railway at Crewe, some more expeditious method than "man-handling" for loading engines with coal, and after much deliberation a mechanical coal-handling plant, made by Messrs. Babcock and Wilcox, and the joint design of the author and that firm, was adopted. The points to which careful consideration had to be given were numerous, particular attention being paid to the following:—

1. The cheap rate at which coal is at present dealt with by hand.
2. The large size of the coal mined, and the class and size of coal wagons in use in England.
3. The regular supply of coal between colliery and steam-shed.
4. The restricted area available, and the high cost of land for extensions and alterations to steam-shed yards.
5. The impracticability of an appliance capable of dealing with coal between wagon and tender, wagon and stack, or stack and wagon.
6. The expenditure necessary for installing such a plant.
7. The breakage of coal during the transfer.

The plant at Crewe consists of a wagon tippler, an underground hopper, a tippling tray conveyor, an elevated bunker, and shoots—including calibrating chambers—for discharging coal on to the tenders. The tippler is of mild steel rolled sections, with rings 12 ft. in diameter, and is capable of tipping a wagon in about five minutes, when attended by two men. It is driven by a 660 volt direct current electric motor of 5 h.p. The hopper constructed of mild steel plates and angles, holds about 20 tons, the coal being fed therefrom by a jigging tray through an adjustable door into a two roll breaker, where the large lumps are reduced to 8 in. cubes. The breaker is belt driven by an independent direct current electric motor of 10 h.p., which also operates the jigging tray. Coal passes through the breaker to the conveyor trays, which carry it to the overhead storage. The conveyor runs at a speed of 70 ft. per min., and is capable of lifting about 60 tons per hour. All the coal is delivered over the end of the conveyor track, when it has only a fall of about 1 ft. on to the inclined shoot which delivers it to the requisite division of the bunker. The speed of coaling by this plant is quite satisfactory—as much as 6 tons being put on in three minutes, as against 5 tons in fifteen minutes with the old system under the most favourable circumstances. An ash conveyor has been installed in conjunction with the coaling plant. When an engine has received its coal, it draws down to a point a little distance away, where the firebox ashes are raked out by hand on to a sloping plate, which slides the ashes on to a grid (with 4 in. mesh) fixed close to the side of the pit. This grid covers a small hopper which feeds the conveyor through a rotary filler. The ashes are then raised and delivered into a wagon standing on an adjoining line. The conveyor, which is of the bucket type, has a capacity of about 15 tons per hour, and is driven by a 3 h.p. direct-current motor.

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On the occasion of his retirement from the position of General Manager of the Midland Great Western Railway, Mr. Joseph Tatlow was entertained at dinner by the members of the Irish Railway Managers' Conference. Mr. James Cowie, Manager, Midland Railway (Northern Counties Committee), presided over a large gathering, thoroughly representative of the railway and steamship interests of Ireland, and in proposing the toast of the evening, said they all regretted the severance of Mr. Tatlow from the Managers' Conference, but at the same time they were glad it was not caused by infirmity or ill-health. On the contrary, he resigned to undertake the less arduous duties of a director. They congratulated him not only on that honour, but also on his appointment as a member of the Dominions Royal Commission, and trusted that the labours of that important Commission would have the effect of strengthening the ties of mutual interest which united the various units of our vast Empire. That the transport interests had been recognised on the Commission was a great compliment to the railway and steamship companies, and the selection of Mr. Tatlow was an acknowledgment that Irish railway management is not devoid of merit. They would miss Mr. Tatlow's counsels and sound judgment. They all recognised the courteous, friendly and dignified demeanour which characterised him. They remembered his successful defence of the Irish railways before the Vice-Regal Commission, which firmly established his reputation as a railway statistician and economist. He presented his case with such success as to evoke from one section of the Commissioners the statement that the Irish railways had done as well as possible, and from the other section the more pronounced opinion that the railways had done their duty and were entitled to an acquittal on the charges brought against them. Mr. C. H. Dent, General Manager, Great Southern and

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Western Railway; Mr. J. McDowell, Manager, Belfast Steamship Company; and Mr. P. Sullivan, Manager, West Clare Railway, joined in the warm tribute offered to Mr. Tatlow, who, in reply, said he was particularly gratified at the presence of Colonel Plews, who had left them a year or so ago to meander in the placid paths of leisured ease. He did not think his own retirement would have come so soon, but he had grasped the skirts of happy chance, and now that the precedent had been set in the cases of Colonel Plews and himself being elected directors of their Companies, he counselled all the Managers present to have a like ambition. He had been 27 years in Ireland, and during that time had seen a remarkable development in the Irish railways. Their length had increased only a little more than one-third; the population of the country had greatly decreased, but the railway revenues had more than doubled. They had passed through troublous times during those years. He recalled with great pleasure the establishment of the Irish Branch of the Railway Benevolent Institution. He might almost say he had rocked its cradle, tended it during its infancy, and with the assistance of the capable committee had established it in its present position. One of his keenest regrets was in retiring from the Chairmanship of the Irish Branch of that Institution but under the able guidance of Mr. Dent, who had been elected Chairman, he was sure it would show a still greater improvement at the close of the year.

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At the University of Sheffield the course of twenty lectures on Railway Economics have attracted unusual attention. The syllabus divides the series into the following sections:—Introduction: The scope and method of economics. The relationship of problems of transportation to other problems of economics. The Demand for Commodities and Services: The principal characteristic of demand: the falling off in the quantity consumed with a rise in price. The elasticity of demand. The joint nature of demands. The influence of the existence of substitutes on the demand for a particular commodity or service. Examination of the character of the demand for railway services. Production of Commodities: The agents of production: land, labour, capital, organisation. The two principal tendencies in production: increasing costs, decreasing costs. The joint supply of two or more commodities. The economies of large scale production. The growth in the size of business undertakings. Combinations and amalgamations. Production of Railway Services: The organisation of a railway. Large capital and considerable working expenditure independent of the amount of service provided. The tendency to increasing and decreasing costs. The joint character of the services supplied. The movement in favour of amalgamation and working agreements. The choice between co-operation and competition. The Railway Clearing House. The Price of Commodities: The determination of price under competitive conditions. The balancing of the forces of demand and supply. The distinction between temporary (short period) and ultimate (long period) prices. The determination of price under monopoly conditions. Price in relation to cost of production: reasons for selling the same commodity at different prices to different consumers (differential charges). The Price of Railway Services: The extent to which railways

REPRODUCTION OF AN EXCELLENT SPECIMEN OF COLOUR PRINTING, EXECUTED BY THE PHOTOCHROM COMPANY, LIMITED.

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operate under competitive and monopolistic conditions. Rates and fares in relation to cost of service: impossibility of exact allocation of fixed charges, the need for taking the value of the service into consideration ("charging what the traffic will bear"). Classification as a practical means of effecting differential charges. Distance as a basis of charging. Special rates and fares. The State in relation to Railways. Requirements with regard to safety. The fixing of maximum rates and fares. The control exercised by the Railway and Canal Traffic Commission. The Nationalisation of Railways. In the lectures reference is made to Continental and American, as well as to British Railway conditions. The course was resumed, after the Christmas vacation, on January 9th.

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THE Nottingham and Derby Section of the Permanent Way Institution devoted its December meeting to a lecture on Cab Signalling by Mr. W. H. Dammond. The speaker first exhibited a set of visual cab signals, home and distant, which had been used in the full-size tests on a section of standard gauge track. These full-size signals were mounted on a miniature car running on a model track equipped with the necessary ramps. In this way the speaker showed how in his system complete distant, home, and starting signals are given without requiring any form of fixed block signal. Mr. Dammond considered the question of impact between moving train and co-operating track apparatus. Cab and fixed signalling were compared, the lecturer asserting that accidents such as the recent Vauxhall collision, when a driver mistook the signals applying to the line on which he was travelling, could not possibly occur with an exclusive cab signal. He claimed that fixed block signals are inferior to cab block signals in enabling drivers to watch the track. Firemen could not possibly tell whether drivers obeyed fixed signals, but could always instantly check a driver's failure to obey adverse cab signals. In the discussion that followed the lecture, impact in and electrical requirements for cab systems were reviewed, the speakers frequently making use of the apparatus to settle questions that arose. Among those who took part were Mr. Pugh, the chairman; Mr. Morgan, Assistant Signal Superintendent, Midland Railway; Mr. Gilbert, of the Glyco-Metal Co.; and Mr. Abbott, of the Midland Railway Electrical Department.

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THE following is a complete list of the second batch of "Scott" type locomotives on the North British Railway. They are 12 in number, the names and numbers being as follow:

No.	Name.
243	*Meg Merrilies.*
244	*Madge Wildfire.*
245	*Bailie Nicol Jarvie.*
338	*Helen Macgregor.*
339	*Ivanhoe.*
340	*Lady of Avenel.*
359	*Dirk Hatteraick.*
360	*Guy Mannering.*
361	*Vich Ian Vohr.*
362	*Ravenswood.*
363	*Hal o' the Wynd.*
400	*The Dougal Cratur.*

The two last named have superheaters. All these engines are fitted with the automatic vacuum brake, in addition to the standard Westinghouse. Recently the Company have been making the experiment of working several of their principal express trains with the vacuum apparatus, and it is anticipated that the latter will in future be adopted as their standard brake, thus bringing them into line with most of the large English companies. At present the Glasgow and South Western and the Highland are the only two Scottish railways which have adopted the vacuum as their standard brake.

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THE monthly edition of the London General Omnibus Map and Guide is now issued by Mr. Frank Pick, of the Traffic (Development and Advertising) Department representing the Metropolitan District Railway Company, the London Electric Railway Co., the London United Tramways Limited, and the London General Omnibus Company, Limited. There are at the present time no fewer than 93 different omnibus routes worked in connection with this powerful combination of railway, tramway and omnibus interests in the Metropolis, and 26 of the omnibus services are extensions of those of the Underground. Three new omnibus routes have recently been added to the list. One of these (No. 75)—run in conjunction with Messrs. Tilling, Limited—is from the free ferry, at Woolwich, to the Swan and Sugar Loaf, on the route of the Croydon Corporation tramway to Purley. Every month 350,000 copies of this useful map are distributed gratuitously, and in the January issue a leaflet has been enclosed entitled "Hints on How to Avoid Accidents"—in getting on and off a motor 'bus and in crossing a street. Cyclists are advised not to hold on to motor 'buses either in motion or stationary, nor to ride through congested traffic "when the speed is too slow to make keeping one's balance easy." Parents are urged to warn their children against several common dangers, and pedestrians generally would do well if they followed the two simple recommendations contained in the leaflet —Keep to the right on the footpath, and "don't step on and off the kerb to get past other people or in absent-mindedness." The "Underground" Calendar for 1913, issued from the same source, consists of a series of sheets for the respective months, each having a seasonable view obtained in Kew Gardens and reproduced in colours on a brown ground, an appropriate quotation, and the usual table of dates. January bears a winter view. For succeeding months the views portray the progress of the year, with suitable quotations.

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MR. A. E. DIGGINS, Traffic Manager of the Stratford-upon-Avon and Midland Junction Railway, speaking at the Company's annual staff supper, said they had now completed four years as an amalgamated railway, and had accomplished much during that time, but still there was a lot to be done. They had amalgamated four small railways which were previously in a derelict condition, and had tried their best to put the company on a firm footing as a dividend-paying concern. When they

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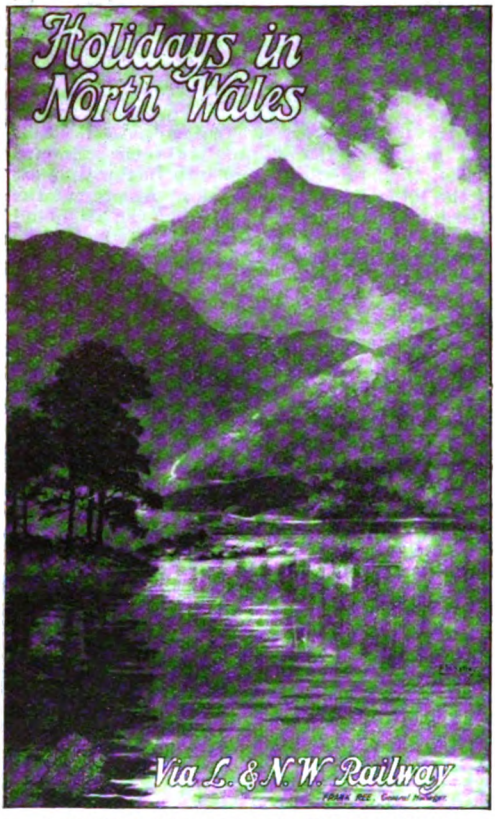

A LONDON AND NORTH WESTERN POSTER.

realised that during this period they had distributed, by way of interest and dividends, considerably over £45,000—and that previous to that scarcely anything had been paid—they might very fairly claim that something had been done. They had directors of whom they were proud, including the Chairman, Mr. Harry Willmott, a most indefatigable worker, a thorough railway man, who always took the deepest interest in the line and personally in every member of the staff.

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THREE posters have been issued by the London and North Western Railway. One, reproduced above, bears a typical lake and mountain view, its motto being "Holidays in North Wales." The second directs attention to the connections between the North London and Central London Railways. A diagrammatic map indicates that by means of the links between the two lines at Liverpool Street, it is now possible to travel under cover all the way from Tring, Kew and Richmond, Potters Bar or Bow and Poplar to the various Central London stations. Through fares, frequent trains, no waiting, and escalators to and from the "tube" station constitute other inducements for using this convenient route between the districts served by the North London and London and North Western Railways and the central and western areas of the Metropolis. The third poster relates to London and North Western postcards, 60 different sets of which are now available. Issued at 2d. per set of 6, they constitute an instructive pictorial record of the line from the early "thirties." We learn that over 10,000,000 of these cards have already been sold.

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A NEW edition has been issued of the Great Eastern Railway Company's attractive illustrated suburban guide "By Forest and Countryside," which forms one of the series published by the Homeland Association. The book reveals the beauties of many of the eastern residential districts of greater London which have advanced so much in popular favour within recent years. The character of the train services—their frequency, rapidity, and small cost—is clearly indicated and information is presented answering all the leading inquiries which people make when they are face to face with the problem "Where to live round London." No fewer than 144 places are included in the guide, and a sketch plan of the southern section of the Great Eastern Railway is added. Copies of the book may be obtained gratuitously at any of the Company's London offices or upon application to the Superintendent of the Line at Liverpool Street station.

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A SCHOOLBOY'S version of Keats' well-known sonnet beginning "Much have I travelled in the realms of gold"—

Much have I travelled on the South Western old,
And many goodly trucks and engines seen;
Through many busy junctions have I been,
Which men in fealty to H. Walker* hold.
Oft of one wide expanse had I been told
That Dugald Drummond† ruled in his demesne;
I never breath'd 330's† pure serene
Until I saw it come through loud and bold.
Then look'd I at the trains with both mine eyes,
When a new type brings down the fast 4.10‡;
And felt like Churchward§, when with eager eyes
He stared at *The Great Bear*§—and all his men
Looked at each other with a wild surprise—
Silent upon a bridge near Paddington‖.

Wimbledon. C. LESLIE CLEAVER.

Allusions.

* Mr. H. A. Walker is the General Manager of the L. & S.W.R.

† Mr. Dugald Drummond was the last Locomotive Superintendent on the L. & S.W.R., and 330 was his first 4-6-0.

‡ The 4.10 is a down two-hour Bournemouth express.

§ Mr. Churchward designed *The Great Bear*, which was the first "Pacific" type locomotive in England.

‖ Paddington is the London terminus of the G.W.R.

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FOR more than 60 years it has been possible to insure against railway accidents, and the Railway Passengers' Assurance Company, of Cornhill, have now increased the weekly allowance in case of total disablement through an accident to a train to £8 instead of £6 as formerly. The company are also handling baggage, which is insured not only during transit, but from the moment of leaving home or business until return. The premiums are very reasonable.

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For 1s. a limited insurance can be had up to the amount of £20 for a period of 15 days in any part of the British Isles. Other premiums and periods are quoted for up to three months and beyond, and a separate prospectus is issued for world-wide insurance.

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ALTHOUGH ranking as "No. 5, Volume II," in virtue of its evolution from the London and North Western Railway Athletic Gazette, the "L. & N.W.R. Gazette" last issued is to all intents and purposes a new publication. A monthly issue has been entered upon, having a wider purview than that of the earlier quarterly parts. Recreative and educational facilities still provide the principal *raison d'etre*, but the new "Gazette" goes further, and compares in most respects, and by no means unfavourably, with the magazines published in connection with other railways. A portrait of Mr. C. J. Bowen Cooke, Chief Mechanical Engineer, is reproduced as a frontispiece, and among the articles are contributions dealing with Manœuvres in East Anglia, Railway Law, Company Development, Coaling at Holyhead, as well as others of general athletic or social interest. The magazine is well illustrated, and the editors may be congratulated on their first monthly issue.

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THE Jungfraujoch, in Switzerland—the highest railway station in the world—is now lighted by Osram drawn wire lamps, which provide a very effective illumination at a height of 3,475 metres above sea level. A like equipment has been installed at Eismeer, another station on the Jungfrau Railway, as well as in several of the trains on the line, and we are informed that the results are better than have previously been obtained from electric lamps.

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THE construction of the Grand Trunk Pacific's dry dock at Prince Rupert will probably have an important effect upon the shipping trade of the Pacific coast. When the company lays up its steamers, as it does at this time of year, they will be berthed in Prince Rupert in preference to any other port, and this will be their headquarters in consequence. Many of the other coast steamers which are at present forced to go elsewhere for repairs and overhauling will tie up in future at the terminus of the Grand Trunk Pacific Railway whose new plant will be capable of handling 20,000 ton vessels. Already a 300 foot pier has been erected and rapid progress is being made upon the mammoth structure. The telephone system of train despatching is being gradually extended by the Grand Trunk Railway, and as soon as the line can be completed will be put into force right through from Montreal to Chicago on the main line.

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A PRESENTATION plate in this issue of the RAILWAY MAGAZINE shows one of a series of goods engines fitted with Schmidt superheaters, recently constructed for the Great Eastern Railway at Stratford. We are indebted to Mr. A. J. Hill, Locomotive Superintendent, for a photograph and particulars of these locomotives, which correspond generally with the large class with Belpaire firebox introduced by Mr. James Holden, and continued by Mr. S. D. Holden, the differences relating principally to the superheater equipment and the use of a 28 in. stroke with 20 in. cylinders. The boiler has a mean internal diameter of 4 ft. 8½ in., the barrel being 11 ft. 9 in. long, while the outer firebox is 7 ft. long. Steam pressure is 160 lb. per sq. in., and the boiler contains 158 tubes, having an external diameter of 1⅞ in., and 18 tubes for the superheater elements 5 in. diameter. The heating surface is made up as follows: Small boiler tubes, 874·7 sq. ft.; large boiler tubes, 282·7 sq. ft.; firebox, 117·7 sq. ft.; superheater, 226 sq. ft.; total, 1,501·1 sq. ft. Grate area is 21·6 sq. ft. The coupled wheels are 4 ft. 11 in. diameter, distributed over a wheelbase of 17 ft. 8 in. They carry the whole weight of the engine, which is, in working order, 47 tons 7 cwt. 2 qr. The tender is mounted on six wheels, 4 ft. 1 in. diameter, and has a coal capacity of 5 tons, with water capacity for 3,500 gallons. Chimney and cab correspond with the present Great Eastern standards, and the usual fittings and equipment, including a mechanical lubricator, are supplied. Ten engines are at present included in the class, which is known as the E72 series.

Photo] *Elliott & Fry.*

MR. A. J. HILL,
Locomotive Superintendent, Great Eastern Railway.

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MR. RUSSELL WILLMOTT, the General Manager, presided when the officials and staff of the Isle of Wight Central Railway met together at dinner—an occasion which all present hoped might in future become an annual event. The toast of the evening was submitted by Dr. J. B. McKay, one of the local medical practitioners, who was able to contrast the Company's services of to-day with those of the past. Describing the experience of travellers 15 years ago, he said that "when they left home in the morning they never knew how much money they would want, as the fares seemed to be altered daily, and the trains seldom ran to time. But now things were altered, thanks to those with great railway knowledge and organising ability who had lately come amongst them." The whole system had been improved, the permanent way thoroughly repaired, the carriages re-decorated and made more comfortable, the platform at Newport station greatly extended and efficiently lighted by electricity, and penny-a-mile fares introduced from the first train in the morning till the last at night. All these improvements would in time diminish the expenditure and increase the receipts. Mr. Russell Willmott had a very cordial reception when he rose to respond to these complimentary words, everyone knowing the real and substantial progress made by the Company during the first year of his management—progress which suggests that he may possibly be able to leave in the Isle of Wight a record little less remarkable than that established by his father and himself at Stratford-on-Avon.

* * *

MR. HENRY CURRINGTON, Rolling Stock and Mileage Controller of the Great Central Railway, retired from active service at the end of last month (January), after 54 years' connection with the railway systems of this country, 40 of which were spent in that of the Great Central. He began his career early in 1859 as a parcels boy at Guildford, and later joined the Railway Clearing House, which he left after a period of 12 years to join the Great Central (then the Manchester, Sheffield and Lincolnshire) as a travelling inspector. For 24 years he was attached, in various capacities, to the Chief Goods Manager's office, Manchester, and on the opening in 1899, of the London extension line, was appointed to take sole charge of the rolling stock and the accounts connected therewith, establishing his head offices in Sheffield as being the most central position after the opening of the London line. As an indication of the regard in which his ability and unique knowledge of the system were held, it may be noted that Mr. Currington was invited, on reaching the age limit (65) in January, 1912, to continue his appointment for a further period of twelve months, and he retires with the good wishes of numerous friends whose acquaintance he made during the course of his long and honourable career.

* * *

A MARKED improvement has been effected in the regularity of the Paris and London services by the Newhaven and Dieppe route as the result of the recent introduction of two 24 knot steamers which cross the Channel in 2¾ hours. During December last, in spite of the rough weather experienced in the Channel, the day service from Paris reached Victoria exactly to time with three exceptions, when the delay was confined to a few minutes. The night service from Paris shows a still higher record, as only once did it fail to reach Victoria on time, and was then only 2 min. late. The same standard of punctuality was observed in the services from London to Paris, there being only three instances of 5 min. delay in Paris of both services during the month. Considerable publicity was given to the delays which occurred on the French State Railway shortly after that administration absorbed the old Western Railway of France, and before the new management had time to promote a higher discipline or to improve the permanent way, towards which the French Government voted large credits.

* * *

THE first of the long-expected four-cylinder 4-6-0 simple engines is now in hand at Crewe. There are to be ten in all of the class built. The first will be named *Sir Gilbert Claughton*, after the able and popular Chairman of the Company, and the succeeding nine after individual members of the Board of Directors. The engines will have 16 in. by 26 in. cylinders, 6 ft. 9 in. coupled wheels, and a working pressure of 200 lbs. to the sq. in., besides being equipped with the Schmidt superheater. A series of ten 0-8-0 mineral engines with 20½ in. by 24 in. cylinders and superheaters is in course of construction, and will be numbered as follows:—955, 1108, 2162, 2225, 2281, 2289, 2301, 2374, 2380, and 2405. The first-named takes the place of the celebrated locomotive *Charles Dickens*, which has been broken up. Work will shortly be begun on a new series of 4-4-0 ("George the Fifth") passenger engines. No. 514 *Lawrence* (6 ft. 6 in., 2-4-0) has been renamed *Puck*.

* * *

THE class of engine which is most affected by the re-numbering scheme introduced by Mr. G. J. Churchward, Locomotive Superintendent of the Great Western Railway, appears to be chiefly, the 4-4-0 type in its various forms, and 4-4-2, 4-6-0, and other engines bearing miscellaneous numbers. In the intermediate stage the practice adopted has been to remove the number plate on one side only, usually the right, and at the same time to paint out the figures of the number on the leading buffer beam. In the case of the earlier engines of the types now uniformly converted into "Cardiff" and "City" classes, and fitted with a combination name and number plate, the name is naturally also removed. The scheme of re-numbering has been introduced in pursuance of the policy of standardisation now being carried out at Swindon.

* * *

A BOOKLET has been issued by the London and North Western Railway Company giving particulars of the golf links on or near their system. Tickets at a single fare and a third for the double journey (minimum 1s.) are issued to individual golfers on surrender at the booking office of a voucher on approved form signed by the secretary of the golf club. Fishermen, too, will be glad to learn that the company have published a booklet which furnishes the names of over 100 angling stations and gives

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the waters that may be fished, the fish that may be looked for, and the names and addresses of those to whom to write for further information. Copies of both books may be obtained free on application at any London and North Western station, agency, Town office, or from the Enquiry Office, Euston station, N.W. With the object of bringing North Wales more prominently before the notice of those who are seeking an ideal winter health resort, the Company have issued another booklet giving full particulars of the charms and varied attractions of that district, where fogs are unknown, and the light rainfall ensures a dry climate with a maximum amount of sunshine. Of this and other popular holiday centres on their system, the Company now offer to visitors fine art engravings as souvenirs.

* * *

THE thirteenth report read at the Annual General Meeting of the Railway Club indicated that the society occupies a very satisfactory position, and that the acquisition of new premises at 92, Victoria Street, has justified itself. From the financial statement presented by the Treasurer it appeared that a creditable balance is carried forward, notwithstanding the heavy and unusual expenses which had to be met during 1912. An excellent programme of monthly and intermediate meetings has been arranged, and several proposed visits will shortly be announced. At the conclusion of the general business Mr. J. F. Gairns gave an account of some of his experiences and recollections concerning the principal railways of Great Br tain.

i * * *

THE subway which runs from next door to the Science Museum in Exhibition Road to both the South Kensington Underground stations has additional advantages now that two extra exits have been made, one opening into the grounds of the Natural History Museum (saving the visitor the trouble of going all the way round to the main entrance in Cromwell Road), and the other leading direct into the entrance hall of the Victoria and Albert Museum. It is, therefore, possible to travel underground all the way under cover from any station to the Museum and back again.

* * *

MR. W. J. GRINLING, Chief Traffic Manager of the Great Northern Railway, presided at a dinner when the chief and district officers of the Company entertained Mr. Oliver Bury, the late General Manager, and presented him with a testimonial of high appreciation, on his retirement from King's Cross to take up the office of Managing Director of the Peruvian Corporation. As already stated in the RAILWAY MAGAZINE, Mr. Bury has been elected to a seat on the Board of the Great Northern Company.

* * *

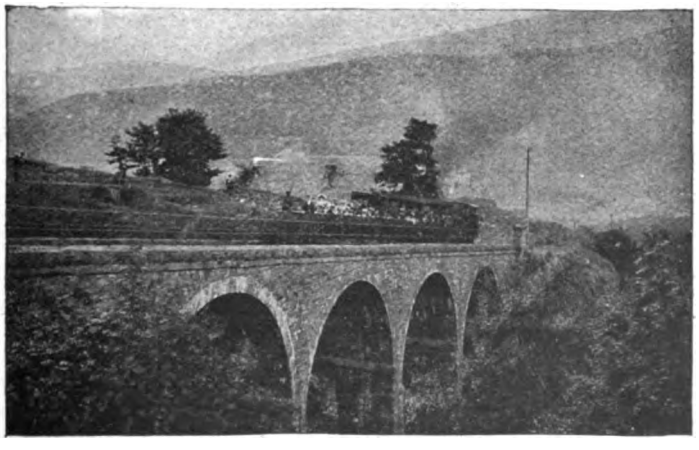
A CORRESPONDENT at Maidenhead sends the following extract from a letter of Disraeli's, written in November, 1838, and wonders whether the run referred to was a "non-stop"? —"I came down by a new engine called the *North Star* (on the Western Railroad), of enormous and unprecedented power. We were only 42 minutes reaching Maidenhead, which is at the rate of 36 miles an hour. It is the only satisfactory piece of railroad travelling I ever performed."

* * *

IT is expected that the new electric line of the London and North Western Railway from Harrow to Watford will be opened early during the present month (February), but the electrification of the whole of the Company's suburban lines, involving an outlay of something like £5,000,000, will occupy about three years.

* * *

WE are informed that the Schmidt Superheating Company, Ltd., have secured orders for 59 engines for the Great Indian Peninsula Railway, to be fitted with their superheater and piston valves. The builders are Messrs. Vulcan Foundry, Ltd., of Newton-le-Willows.



VIADUCT, SNOWDEN RACK RAILWAY.

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Railway Literature.

DICTIONARY OF RAILWAY TERMS IN SPANISH-ENGLISH AND ENGLISH-SPANISH. [London: Constable & Co., Ltd., 12s. 6d.] The author of this book, Señor Andres J. R. V. Garcia, has assiduously devoted himself to the task of bringing together in one volume of convenient size not merely the principal words that are in common use in connection with railway construction and operation, but the rarer terms for which one often consults in vain ordinary sources of reference. Señor Garcia has included the special terms which he found employed in Cuba, Mexico, and South America; and if it be made available in connection with the gigantic development of railway enterprise in the last-mentioned country alone, this dictionary cannot fail to prove of great value. It answers queries that must inevitably arise in the laying out of new lines, in the supply of all kinds of rolling stock, in designing stations, hotels, garages, and all other adjuncts of modern transportation; while it may further be regarded as an indispensable accessory in the course of everyday railway routine where some knowledge of Spanish and English is essential.

* * *

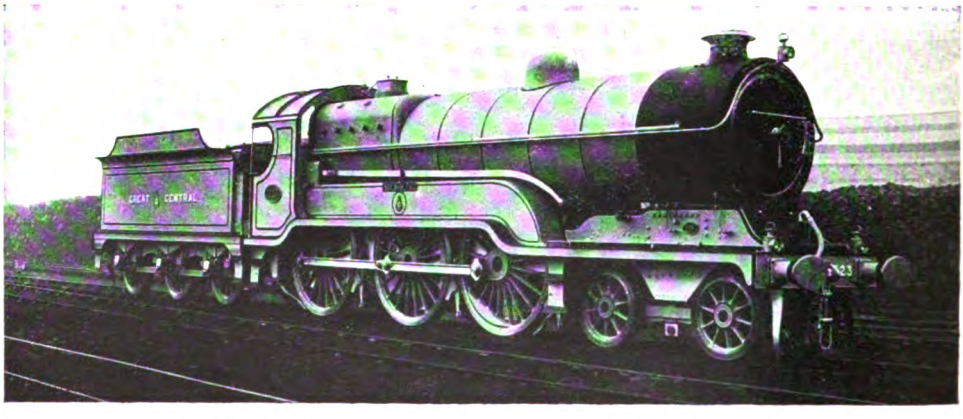
MODERN RAILWAY WORKING. [Gresham Publishing Co.] The second volume of this series of practical treatises has been issued, and it fully maintains the high standard of the initial volume. Mr. Cyril Hall deals with the organisation of the departments of the General Manager and Superintendent of the Line; Mr. Walter Gott, formerly Chief Passenger Agent, London Electric Railways, covers the organisation and duties of the Goods Department; and Mr. Hall, Mr. James Clayton (Locomotive Department, Midland Railway), and Capt. W. H. Woodward (Assistant Port Master, Grimsby, Great Central Railway) supply contributions relating respectively to the engineering, locomotive and docks and marine departments. The second division includes articles on planning and setting out new lines, the design and construction of earthworks (by Mr. Owen T. Wood), and railway masonry works (by Mr. E. Connal, Chief Engineer, Midland and South Western Junction Railway). Seven plates and a large number of diagrams, drawings, and photographic reproductions provide adequate illustration of the volume.

* * *

THE STATE IN RELATION TO RAILWAYS. [P. S. King & Co. Price 1s. 6d. net.] A reprint of papers read at the Congress of the Royal Economic Society in January, 1912. There are in all seven contributions. Mr. Acworth deals with "The State in Relation to Railways in England" Mr. W. T. Stephenson considers the "State Control of British Railways"; "Parliament and the Railways" is treated by Mr. E. Cleveland-Stevens, while Professors Schumacher, Beaulieu, Mahain and Dewsnup supply contributions respectively on "State Control and Ownership of Railways" in Prussia, France, Belgium, and the United States.

* * *

THE FIRST RAILWAY IN LONDON. *Locomotive Magazine*, Souvenir No. 21. [By A. R. Bennett, M.I.E.E. Price 3s. 6d. net.] This booklet tells the story of the London and Greenwich Railway from 1832 to 1878. Mr. Bennett has collected much valuable information concerning the line, beginning with its construction, and ending with its extension to Maze Hill, Charlton and Woolwich, when the Greenwich section lost its individual importance, becoming merely a part of the South Eastern suburban system. Numerous illustrations are included, with a coloured plate of one of the early locomotives.



Photo] [*Topical Press.*

GREAT CENTRAL RAILWAY.

Express Locomotive, No. 423, "Sir Sam Fay," designed by Mr. J. G. Robinson, Chief Mechanical Engineer. Weight of engine and tender in working order, 122 tons. This engine is to be exhibited at the International Exhibition, Ghent.

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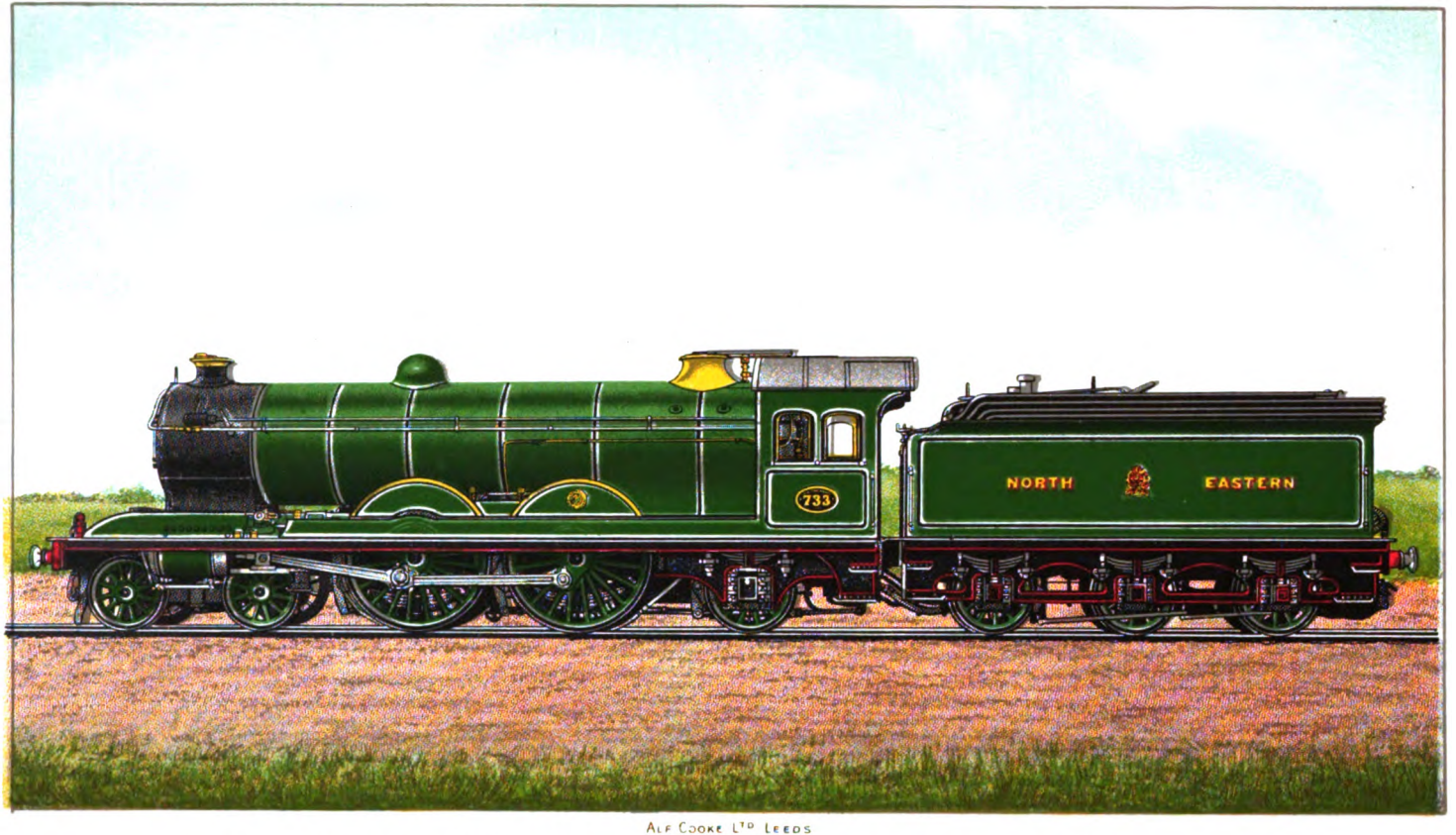

ALF COOKE LTD LEEDS

NORTH EASTERN RAILWAY THREE-CYLINDER "ATLANTIC" EXPRESS LOCOMOTIVE, No. 733.

FITTED WITH SCHMIDT SUPERHEATER.

DESIGNED BY MR. VINCENT L. RAVEN, CHIEF MECHANICAL ENGINEER, M.I.C.E

CYLINDERS (3), 16½ IN. STROKE, 26 IN. DIAMETER OF COUPLED WHEELS, 6 FT. 10 INS.

HEATING SURFACE 2340 SQ. FT. STEAM PRESSURE, 160 LBS. GRATE AREA 27 SQ. FT.

WEIGHT OF ENGINE IN WORKING ORDER, 77 TONS 2 CWT.

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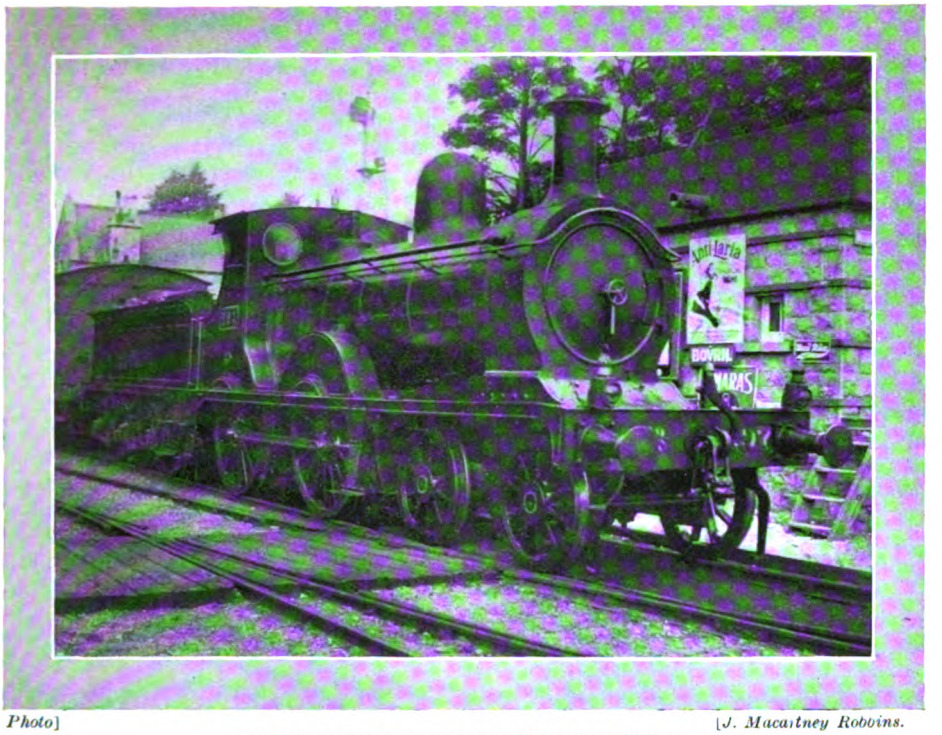

Photo] [*J. Macartney Robbins.*

GREAT SOUTHERN AND WESTERN RAILWAY:
4–4–0 locomotive No. 297, formerly the property of the Waterford, Limerick and Western Railway.

The Waterford, Limerick and Western Railway.

By H. FAYLE.

TWELVE years have elapsed since the Waterford, Limerick and Western Railway lost its separate identity, and it is perhaps desirable that some account of the line should be published in the RAILWAY MAGAZINE before the particulars pass into oblivion. At the time of its amalgamation with the Great Southern and Western Railway in 1901, the Waterford, Limerick and Western was the largest Irish railway not actually terminating in Dublin, and comprised 350 miles of line. It is not generally known that the first railway authorised in Ireland was one to connect the ports of Limerick and Waterford, which were of greater importance at the beginning of the last century than they are now.

These cities occupied in Ireland a somewhat similar position to Edinburgh and Glasgow in Scotland, though, of course, on a much smaller scale. Limerick is situate on the Shannon, which is navigable from its mouth for large vessels, while Waterford is equally favourably placed on the Suir. North of the city of Limerick are rapids impeding the navigation, but a canal about twelve miles in length was constructed to Killaloe to overcome this difficulty. North of Killaloe there is to Leitrim an interrupted stretch of 129 miles available for large steamers, and a regular service was formerly maintained for passengers and goods. The city of Waterford was in regular steam communication with Milford, Bristol and Liverpool, and the construction of the railway, therefore, offered a favourable field to the railway promoter.

In 1826 a scheme was sanctioned by Parliament under the title of the "Limerick and Waterford Railway," with a capital of £600,000, and the proposed line was to pass *en route* through the important towns of Tipperary, Cahir, Clonmel, and Carrick. Owing, however, to local opposition and the difficulty of raising the capital, the project was abandoned; but in the following year well known engineers like George Stephenson

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and Nimmo were responsible for alternative undertakings. A Royal Commission appointed to inquire into the manner in which railway communication could be most advantageously promoted in Ireland issued their final report in 1837. This recommended the construction of a main trunk line from Dublin to Cork through Cashel and Mitchelstown, crossing a lateral line from Limerick to Waterford, about four miles from Cahir. But the scheme had the disadvantage of passing some distance from the important towns of Tipperary and Clonmel, and was not adopted. When the Great Southern and Western Railway was incorporated in 1844 to make a line from Dublin to Cork, the route indicated was *via* Maryborough, Thurles and Charleville.

An Act of May 21st, 1846, incorporated the Waterford and Limerick Railway Company, and authorised the making of a main line connecting those cities, together with some branches, which were afterwards abandoned. This line crossed the Great Southern and Western Railway at Ballykisteen, about 22 miles from Limerick, and the station there was called Limerick Junction. The first portion of the line from Limerick to Tipperary—a distance of 25 miles—was opened on May 9th, 1848, and on July 3rd of the same year, the Great Southern and Western Railway was completed to Limerick Junction. There were six trains in each direction between Limerick and Tipperary, the fastest occupying on the journey 1 hr. 25 mins. At Limerick Junction the two lines crossed on the level. A description of this complicated arrangement appeared in an early issue of the RAILWAY MAGAZINE, but as that number has long been out of print, it may not be out of place to describe briefly the unique device, which still prevails.

The station consists of a single island platform, with a bay at each end. Neither of the Great Southern and Western Railway through roads is a platform line. Consequently all trains, up and down, have to set back to the platform by means of the trailing points, marked "A" and "B" on the plan. This arrangement seems to have been adopted in order to avoid the use of facing points. The Waterford and Limerick trains cross the Great Southern and Western Railway on the level just north of the station, access to which is gained by a single line branch diverging at a place called Kean's Points. A train from the Waterford direction crosses the Great Southern and Western Railway on the level, and comes to a stop just beyond Kean's Points. It then reverses into the bay at the north end of the station, and has a clear run out to Limerick when restarting.

In the case of a train from Limerick, a more complicated series of evolutions has to be performed. After diverging from the main line at Kean's Points, it runs through the station, and comes to a stop at the point marked "C," and then reverses into the bay at the south end of the island platform. When restarting, it is first necessary to pull out to "C" and come to a stop. The next operation is to reverse right through the station to Kean's Points, and after again coming to a stop, to cross the Great Southern and Western Railway, and proceed on the journey. It was originally intended to construct a double line for the whole distance from Limerick to Waterford. In fact the first 16 miles from Limerick were laid double, and the two tracks were continued at a later date as far as Kean's Points, near Limerick Junction.

But the first estimates were largely exceeded, and as a consequence the company found itself in 1848 without any funds to continue the construction. Eventually a further issue of preference stock was made, and, with the help of a grant of £120,000 from the Public Works Loan Commissioners, construction was resumed, but then only for a single track. From Tipperary to Clonmel the line was opened in April, 1852, to Fiddown in April, 1853, and to Dunkitt (near Waterford), in August, 1853. The Waterford and Kilkenny Railway here joined in on the right, and ran alongside for the rest of the distance. Completion of the line into Waterford took place in August, 1854, the original terminus being nearly half a mile from the present station. In 1862 the line was further extended to the toll bridge, where a roofed-in terminus with two platforms was erected. This remained until the rebuilding of the station by the Great Southern and Western Railway in 1906. Till quite recently, the original station was in use as a goods store.

The South Wales Railway was opened to Milford in 1856, and a steamship service with Waterford started the same year. A traffic agreement was signed in 1872, under which the Waterford and Limerick Railway was allowed a rebate not to

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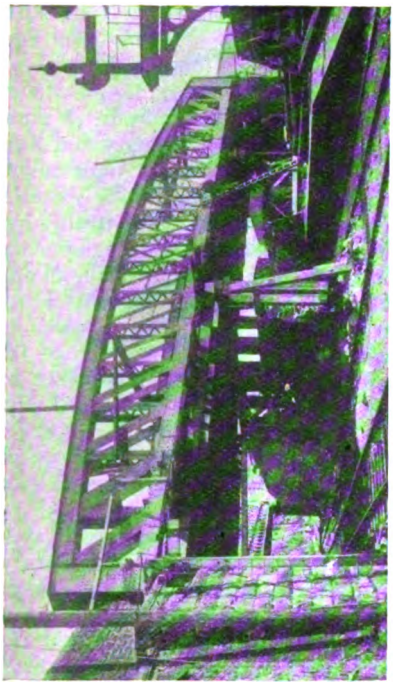
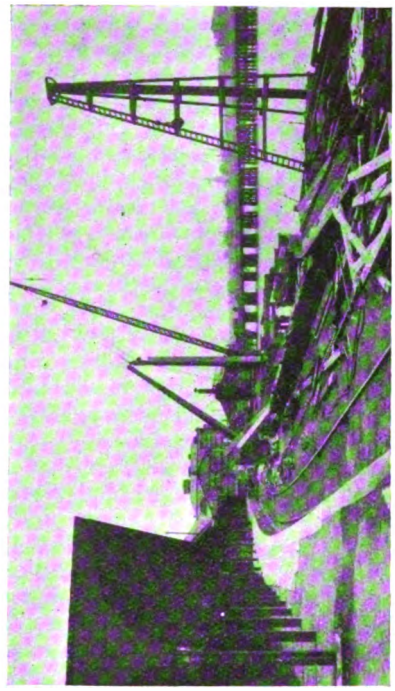
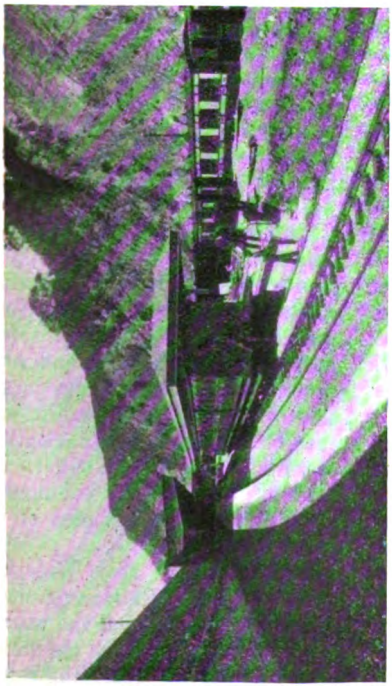


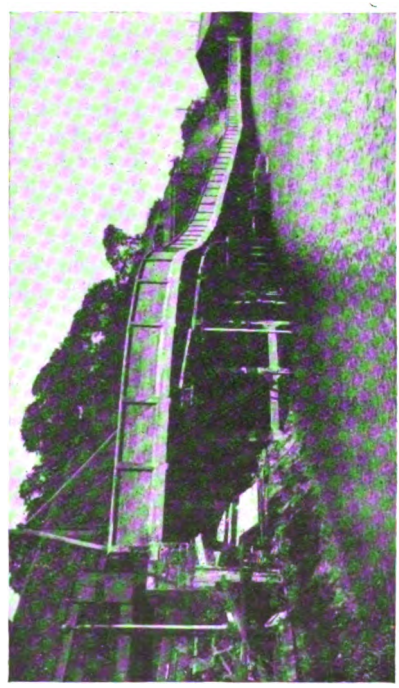
NEW BRIDGE OVER TERMINUS AT WATERFORD, SHOWING OLD BRIDGE IN BACKGROUND.



THE OLD TERMINUS AT WATERFORD (PARTLY REMOVED) SHOWING TOLL BRIDGE.



EAST END OF WATERFORD STATION.



NEW ROADWAY AT WATERFORD STATION.

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exceed £8,600 in one year. A short though important goods extension was opened at Waterford in January, 1884, allowing wagons to run alongside the steamers at the North Wharf. Meanwhile three other companies, in which the Waterford and Limerick Railway was directly interested, had been formed to extend the line at the Limerick end. The Limerick and Ennis Railway, incorporated in 1853, was opened for traffic in 1859; the Limerick and Foynes Railway, incorporated in 1853, to Ballingrane in July, 1856, to Askeaton in May, 1857, and to Foynes in April, 1858; and the Limerick, Castleconnell and Killaloe Railway, incorporated in 1855, to Castleconnell in September, 1858, to Birdhill in May, 1860, and to Killaloe in November, 1862.

These three companies were at first worked by the Waterford and Limerick Railway, but were amalgamated in 1873 and 1874. The western section of the line from Limerick to Tralee was completed by the Rathkeale and Newcastle Junction, and Limerick and Kerry Railways, both of which were worked under agreement. In July, 1857, the section from Ballingrane (on the Foynes line) to Newcastle West, was opened, and thence to Tralee in January, 1881. Newcastle West was a reversing station. The Southern Railway from Clonmel to Thurles was incorporated in 1865, to provide more direct communication between Clonmel and Dublin. This line was opened from Clonmel to Fethard in June, 1879, and to Cabra Junction (near Thurles) in July 1880. It was worked by the Waterford and Limerick Railway.

The acquisition of the northern extension from Ennis to Sligo provides one of the memorable chapters in the history of the line. Two other independent companies—the Athenry and Ennis Junction and the Athenry and Tuam Railways—had been incorporated in 1860 and 1858 respectively. Both connected at Athenry with the Midland Great Western Railway. The Tuam line was opened in September, 1860, and leased to the Midland Great Western Railway for ten years, at the end of which time it was taken by the Waterford and Limerick Railway for twenty years. Opened in September, 1869, the Ennis line was worked independently for three years. It was then leased to the Waterford and Limerick Railway, but in 1887 the Midland Great Western Railway obtained the lease.

In 1890 a number of light railways were promoted by the Government in the West of Ireland. Among these were lines from Claremorris to Collooney, and from Tuam to Claremorris. The Midland Great Western Company, wishing to work these railways, promoted a bill for the purpose including powers to take over the Athenry and Ennis, and the Athenry and Tuam undertakings. This proposal was opposed by the Waterford and Limerick Railway, which itself sought to acquire the lines, but a Parliamentary Committee decided in favour of the Midland Co's bill. In the House of Lords this decision was reversed, and the Waterford and Limerick Company, by an Act of July, 1893, obtained control of the lines, together with running powers over the Midland Railway between Collooney and Sligo. In 1895 the company assumed its more comprehensive title of the "Waterford, Limerick and Western Railway."

To complete the description of the system as taken over by the Great Southern and Western Railway in 1901, it will be necessary to refer to one short line—the light railway from Tralee to Fenit harbour, which, constructed to aid the mackerel fishery, was opened in July, 1887, and worked by the Waterford, Limerick and Western Railway. With these additions, the railway comprised a system of 350 miles, of which only 32 was double line. This included the sections between Limerick and Limerick Junction, as also between Fiddown and Waterford, the latter of which was doubled in 1882. When the Rosslare route to Ireland was proposed, it became necessary for the Great Southern and Western Railway to take over the Waterford, Limerick and Western Railway in order to prevent the latter falling into the hands of an English company. At first proposals for amalgamation were strongly opposed locally, but in January, 1901, the fusion became an accomplished fact. The Waterford, Limerick and Western Railway had never been a financial success, and consequently when saddled with so large an addition of unremunerative line, the Great Southern dividends were bound at first to suffer. This loss has, however, been largely balanced by the additional traffic which ensued on the opening of the Rosslare Route.

The headquarters of the Waterford, Limerick and Western Railway were at Limerick, and that city formed the working centre of the system, from which the various train services originated. Here the station was a terminus with four platforms, three

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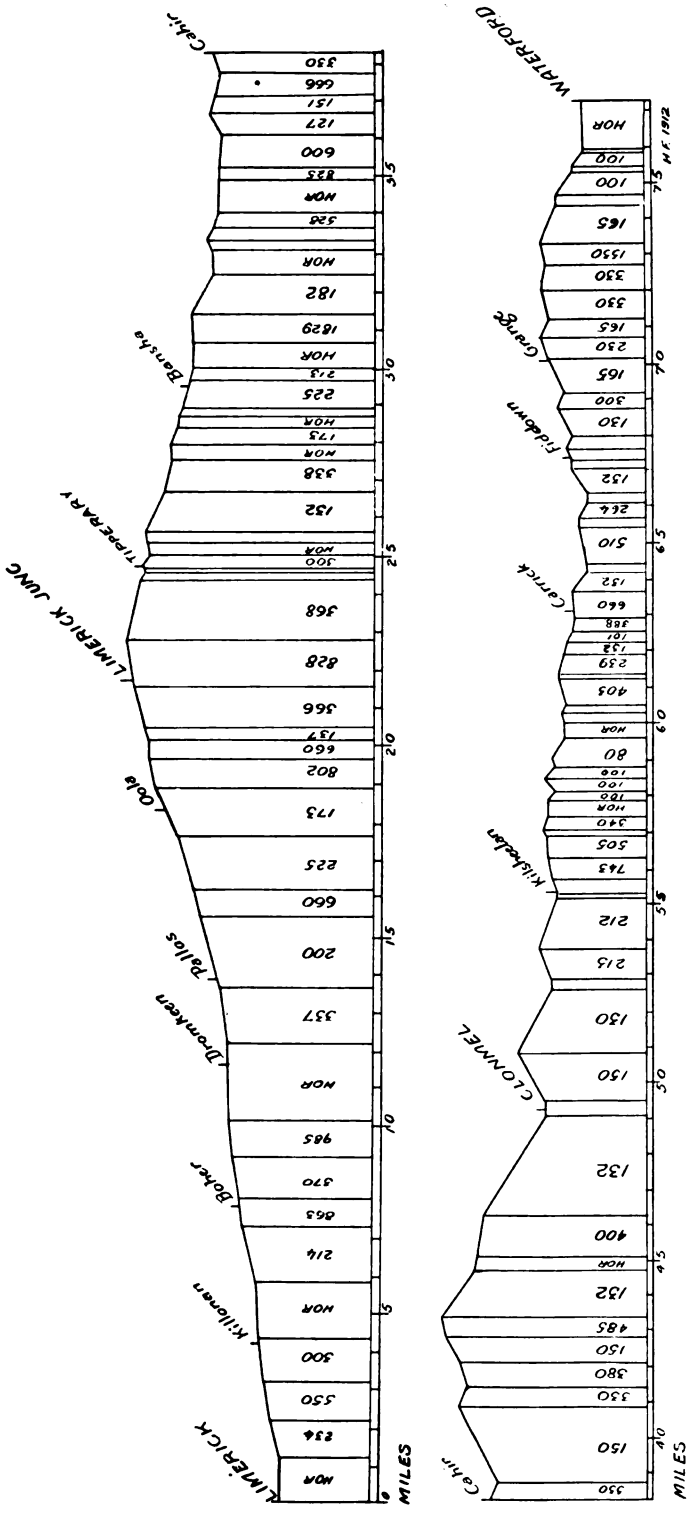

GRADIENT PROFILE—LIMERICK TO WATERFORD: WATERFORD, LIMERICK AND WESTERN SECTION (GREAT SOUTHERN AND WESTERN RAILWAY).

of which were used by the Waterford, Limerick and Western trains, and the fourth, unconnected with the other three, by the Great Southern and Western Railway trains to Charleville and Cork. Between Foynes Junction (Limerick), and Patrickswell, these latter trains ran over the Waterford, Limerick and Western Railway. The Waterford and Limerick trains for Patrickswell and Tralee travelled along the main line for a distance of three quarters of a mile from Limerick. They then came to a stop and reversed their direction before proceeding along the Tralee branch. A short distance beyond the reversing point, the Great Southern and Western line from the station joined in at Foynes Junction. Since the amalgamation some of the Tralee trains have started from the Cork platform, in order to avoid the reversing point. The main line (from Limerick to Waterford), the western section (to Tralee), and the Sligo line, were worked as separate divisions, and trains as a rule did not run through. Before the amalgamation the service consisted on the main line of about four trains in each direction, and three over the rest of the line, excepting that on the Sligo line there were two additional trains which did not proceed beyond Ennis.

Between Limerick and Waterford the fastest trains occupied about three hours over the 77¼ miles, and also had the longest run without a stop, namely, Limerick to Limerick Junction, 22 miles, in 40 min. On the Sligo and Tralee lines all

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the trains were very slow, the fastest times from Limerick to Tralee being 3¼ hrs., and to Sligo 7 hrs. Since 1901 several improvements have been made by the Great Southern and Western Company. The most important of these have been on the Castleconnell and Killaloe section, the line from Birdhill to Killaloe being now worked as a separate branch, while the trains from Limerick run through to Nenagh or Ballybrophy, through carriages to Dublin being provided on two trains in each direction. On the main line to Waterford an additional fast train was put on in each direction, connecting at Waterford with the boat trains to Rosslare. The service on the Tralee line was also improved.

Prior to 1901, the Waterford and Limerick Railway had fairly extensive locomotive and carriage shops at Limerick, and although no new engines were actually built there, several were so altered by re-building as to be practically new engines. The extremely varied locomotive stock comprised a total of 58 in 1901. Passenger locomotives were mostly of the 2–4–0 tender type, though there were two distinct classes. The earlier class were built by the Vulcan Foundry between 1874 and 1882. They had inside bearings to the leading wheels, and, like most of the other locomotives, were named. There were ten engines of this type, which was the most numerous on the line, and their names and numbers were as follow: No. 8, *Primrose;* No. 25, *Verbena;* No. 30, *Lily;* No. 31, *Myrtle;* No. 32, *Dahlia;* No. 35, No. 36, *Violet;* No. 37, *Camelia;* No. 38, *Hyacinth;* and No. 39, *Shamrock.* These engines were latterly mostly used on the Sligo line, but the Great Southern and Western Railway have since scrapped them.

In 1886 the company obtained from the Vulcan Foundry and Messrs. Dubs & Co., two 4–4–0 tender engines which were numbered respectively No. 9, *Garryowen* and No. 12, *Earl of Bessborough.* These engines had small driving wheels (only about 5 ft.) and do not seem to have been a success in the passenger service, as No. 9 was afterwards used chiefly for goods trains, while No. 12 was soon rebuilt as a 2–4–0. About this time Mr. J. G. Robinson, (now of the Great Central Railway) became Locomotive Superintendent, and all the following engines were built to his designs. In 1889 the company obtained the first of a new design of 2–4–0 passenger engine, with outside bearings to the leading wheels; and between that date and 1894 seven others were ordered from Messrs. Dubs & Co. They were named and numbered: No. 10, *Sir James;* No. 20, *Galtee More;* No. 22, *Era;* No. 23, *Slieve-na-mon;* No. 43, *Knockma;* No. 44, *Nephin;* No. 47, *Carrick Castle;* and No. 48, *Granston.* These engines had cylinders 17 in. by 24 in., and 6 ft. coupled wheels. Most of them had bright brass domes and brass caps to the funnels, and they worked principally on the main line between Waterford and Limerick. When taken over in 1901 the names were removed and the domes painted, but all are still at work.

The next and last type of passenger engine were of the 4–4–0 type, with the same size cylinders and driving wheels as the last. These were built, in 1896-7, by Messrs. Kitson & Co., and were very handsome engines. The names and numbers were: No. 53, *Jubilee;* No. 54, *Kilemnee,* and No. 55, *Bernard.* At the same time (1896–7) Messrs. Kitson also supplied four 4–4–2 side tank locomotives with cylinders 17 in. by 24 in., and 5 ft. 6 in. driving wheels, the names and numbers being: No. 16, *Rocklands;* No. 17, *Faugh-a-ballah;* No. 18, *Geraldine,* and No. 21, *Blarney Castle.* The company possessed older tank engines of the 2-4-2 and 0–4–4 wheel arrangements. Tank engines were principally employed on the Tralee line and on the Sligo line north of Tuam. Mr. Robinson also designed a powerful class of 0–6–0 tender goods engine, four of which were, in 1893–5, built by Messrs. Dubs & Co., while four others, the latest of which had a Belpaire firebox, were delivered by Messrs. Kitson & Co., in 1897 and 1900. The carriage stock numbered 101, not including 78 other vehicles which ran on passenger trains. Most of the stock was six-wheeled, but many of the later coaches were quite up-to-date, being provided with lavatories and electric light.

The district served by the line was principally agricultural, and the traffic was to a great extent purely local in character. Waterford, the southern terminus of the line, is a very picturesquely situated city on the Suir, which is navigable for large steamers from its mouth to a point 12 miles below Waterford, while canal boats can proceed up the river to Clonmel, a distance of thirty miles. The direct steamer service which had been maintained with New Milford since 1856, was in 1906 altered so as to run instead to Fishguard, and although it

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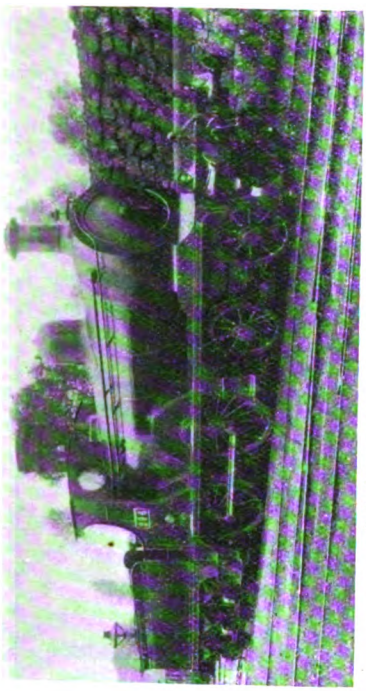
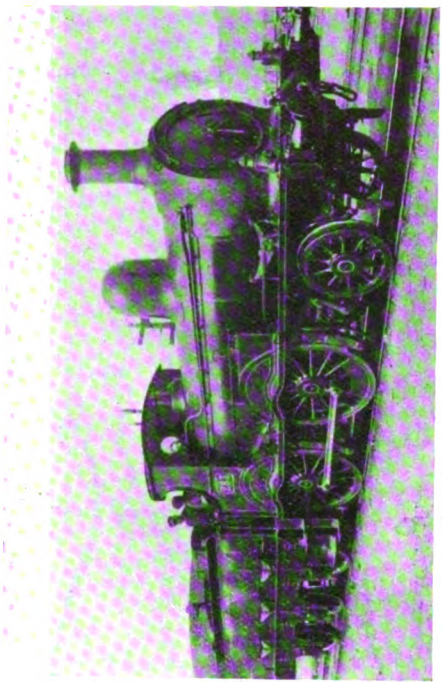
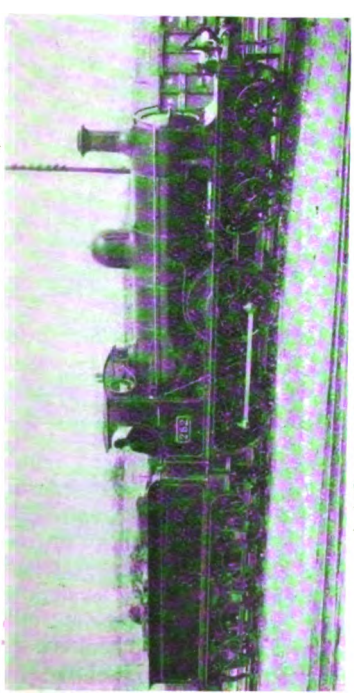


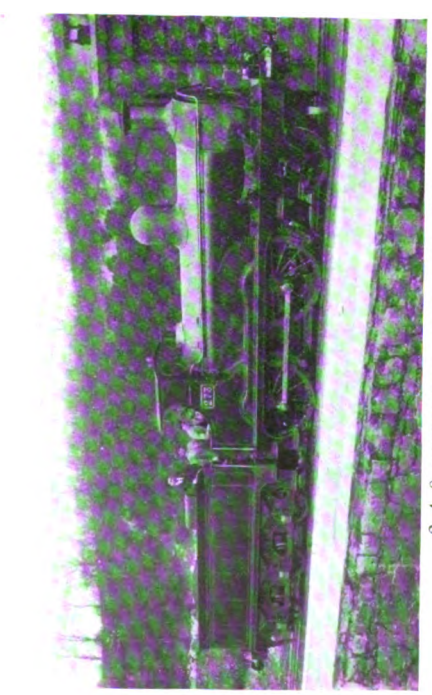
4–4–0 PASSENGER ENGINE, NO. 296.
Formerly No. 53 *Jubilee*, built by Kitson & Co. in 1896.
(Mr. Robinson's second passenger class).



2–4–0 PASSENGER ENGINE, NO. 283.
Formerly No. 32 *Dahlia*, built by Dübs & Co., 1881.
(Old passenger class).



4–4–0 PASSENGER ENGINE, NO. 262.
Formerly No. 9 *Garryowen*, built by Dübs & Co. in 1886.



2–4–0 PASSENGER ENGINE, NO. 273.
Formerly No. 20 *Galtee-more*, built by Dübs & Co., 1892.
(Mr. J. G. Robinson's first passenger class).

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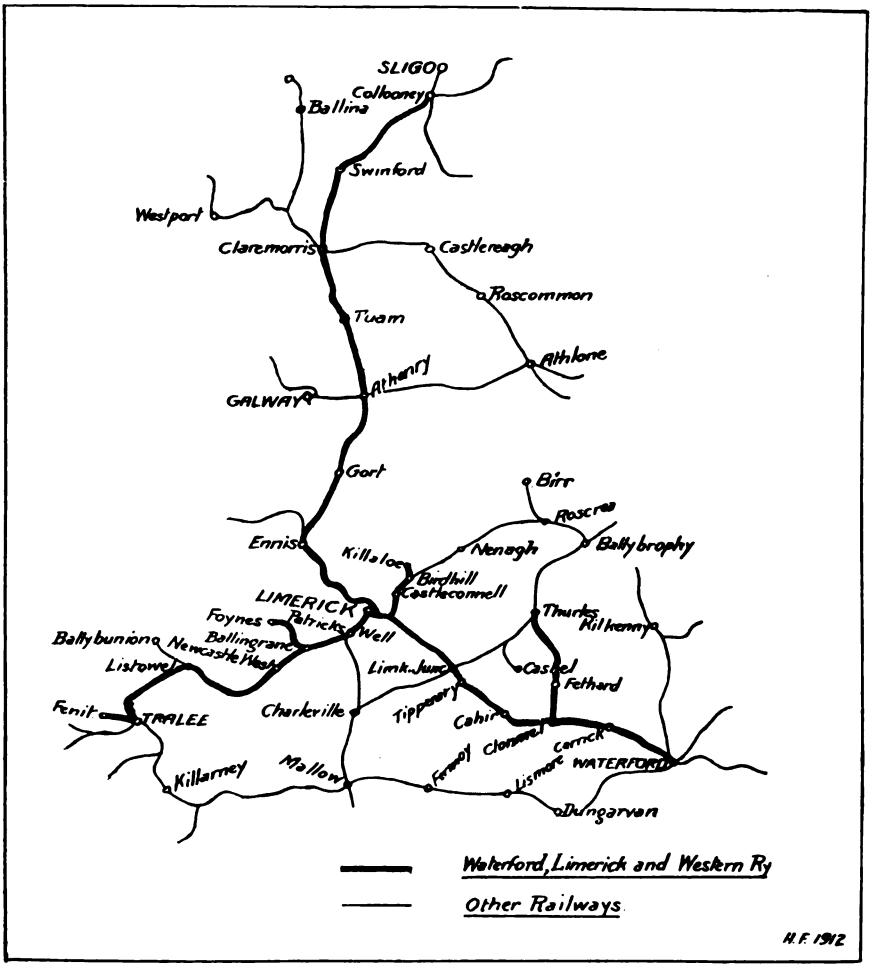
has lost much of its importance since the inauguration of the Rosslare route, it still provides the most comfortable route from London to Waterford to the traveller who is not pressed for time. The sail up the river, usually performed by daylight, is very picturesque, and allows the traveller to recover from the effects of *mal-de-mer* before landing at Waterford. Waterford North Station was entirely rebuilt in 1906, and is now one of the largest and best on the line, while the abolition of the tolls on the bridge crossing the river has been a very welcome improvement. This bridge was recently replaced by a ferro-concrete structure.

After leaving Waterford, the line runs alongside the river for a short distance, and on the left the Comeragh mountains are visible. A run of 14 miles brings us to the old town of Carrick, where are the ruins of a castle built in the time of Queen Elizabeth. As the train proceeds the scenery on the left, embracing mountains and river, is very picturesque. The next station, Kilsheelan, serves the village of the same name and the fine Gurten estate of Count De La Poer. Six miles further on we reach Clonmel, the capital of County Tipperary, a place of some importance, with 10,000 inhabitants. Besides being of historic interest, the town, is very conveniently situate for visiting the attractive scenery in the neighbourhood, while a military garrison and a large brewery add to the local prosperity. The line ascends rather steeply from Clonmel to the Woodroffe summit, and then falls more gradually to Cahir, the Galtee mountains being visible in the distance.



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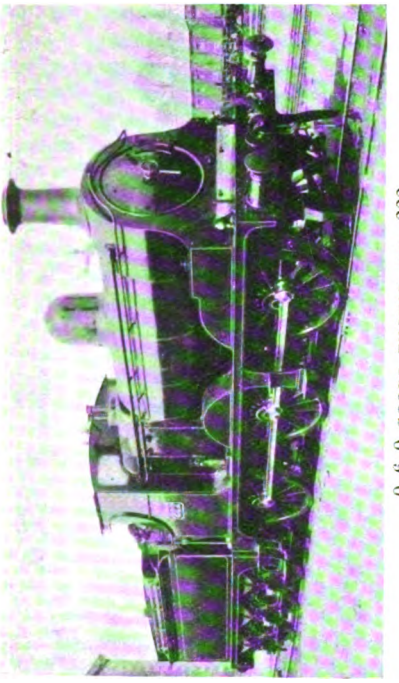
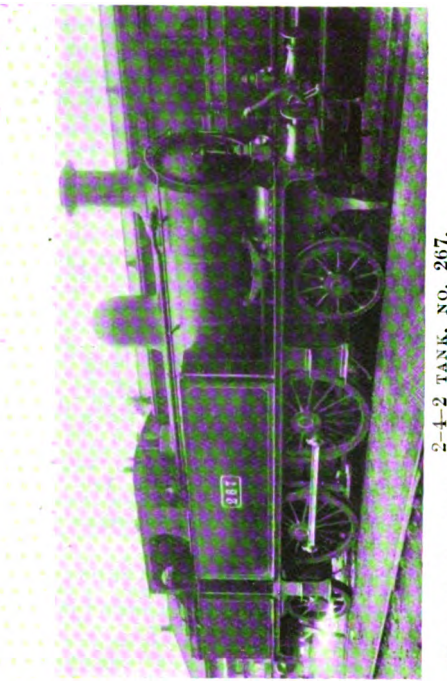
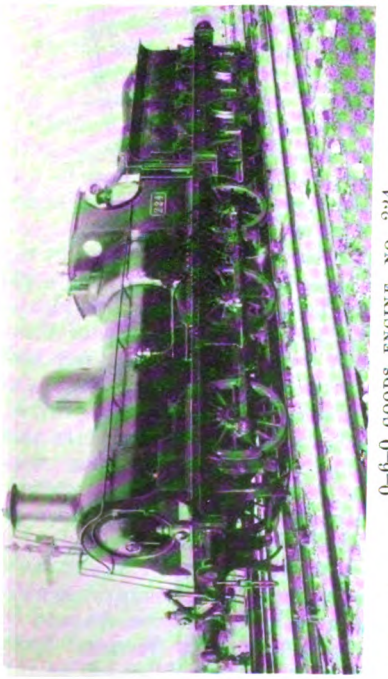


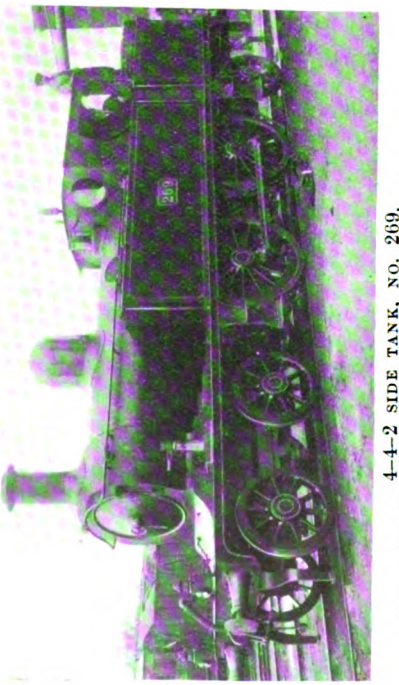
0–6–0 GOODS ENGINE, NO. 222.
Formerly No. 2 *Shannon*, built by Kitson & Co., 1900.



2–4–2 TANK, NO. 267.
Formerly No. 14 *Lough Derg*, built by the Vulcan Foundry, 1891.



0–6–0 GOODS ENGINE, NO. 224.
Originally a 0–4–2 built by Sharp, Stewart & Co., in 1862; rebuilt as a 0–6–0 at Limerick, 1893. Formerly No. 5 *Bee*.



4–4–2 SIDE TANK, NO. 269.
Formerly No. 16 *Rocklands*, built by Kitson & Co., 1896.

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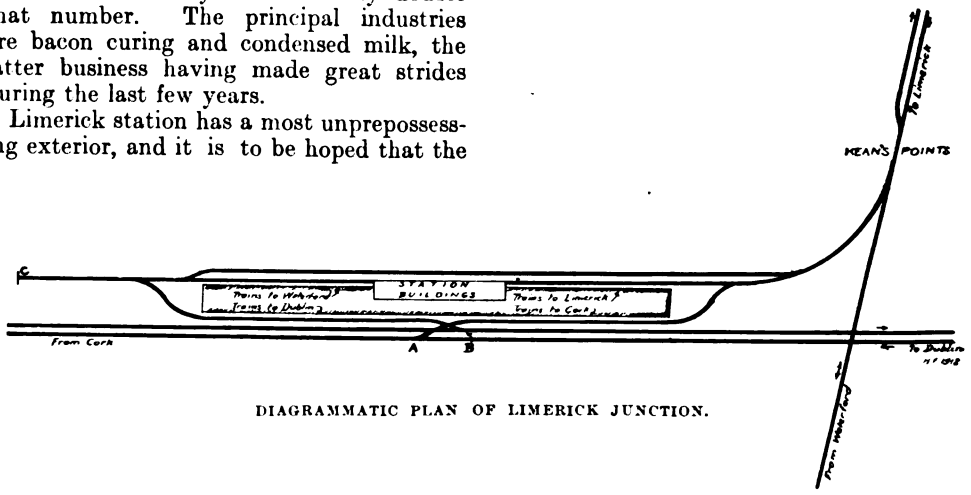
Ten miles to the south of Cahir are the caves of Mitchelstown, and about the same distance to the north the ancient ruins on the Rock of Cashel. The latter are now more conveniently reached by the branch line from Goolds Cross on the Great Southern & Western Railway main line. The next place of importance is Tipperary, a market town of 5,000 inhabitants; and three miles further we cross the main line of the Great Southern and Western Railway at Limerick Junction. For the remaining 22 miles to Limerick the scenery is of a commonplace character, but the countryside is very rich. The city of Limerick, built by the Danes, has a population of about 35,000 at the present day, though at the beginning of the 19th century it was nearly double that number. The principal industries are bacon curing and condensed milk, the latter business having made great strides during the last few years.

Limerick station has a most unprepossessing exterior, and it is to be hoped that the Great Southern and Western Railway will take an early opportunity of remodelling it. During the day nearly 50 trains enter and leave the station; so that it must be reckoned as one of the busiest on the system. From Limerick to Sligo the scenery on the line is throughout of a most uninteresting character. The only intermediate station calling for any notice is Ennis, the junction for the West Clare narrow gauge railway. The latter serves the favourite watering places of Lahinch and Kilkee, while a five mile drive from Ennistymon station will bring the traveller to Lisdoonvarna spa.

On the Limerick and Tralee section the scenery is more attractive, particularly after leaving Newcastle West. The line ascends by gradients of 81 and 61 to the summit level at Barnagh, where the train passes through a short tunnel (the only one on the system), and descends again by gradients of 1 in 80 to Devon Road station. Three miles further we reach the little town of Abbeyfeale, pleasantly situate on the river Feale near the border of County Kerry. The next place of importance is Listowel, an important market town and the starting point of the unique mono-rail line that conveys tourists to the watering place of Ballybunion, which is every year increasing in popularity. There is nothing calling for mention on the remaining 20 miles to Tralee, where connection is made with the Great Southern and Western Railway to Killarney, and also with the Fenit branch. Since 1901 the trains from Limerick have entered the Great Southern and Western station, though the Waterford, and Limerick Company's station was still used for some time afterwards for the Fenit trains.



DIAGRAMMATIC PLAN OF LIMERICK JUNCTION.

While one cannot help regretting that the Waterford, Limerick and Western Railway has lost its separate identity, it must be noted to the credit of the Great Southern and Western Company that the train services and through carriage arrangements have been greatly improved, and the only cause for complaint is that the names have been removed from the locomotives. There were comparatively few engineering works of any size on the Waterford, Limerick and Western Railway. The most important was the bridge over the river Shannon at Longpavement (near Limerick), which has been renewed by the Great Southern and Western Company. There was another smaller bridge over the river Suir at Cahir.

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Railway Signalling in Principle and Practice.

[No. VI.]

By W. E. EDWARDS.

JUNCTION SIGNALLING.

AT junctions, "protection of obstruction" of a different character is, as already noted, provided for; that is to say, not only is the "controlled interval of space" maintained between *following* trains, but protection is afforded in cases of converging movements, as also for "lateral" obstruction, occasioned by crossing trains. The block regulations applying thereto are, consequently, of a very carefully considered nature, and, saving such junctions at which the "warning" arrangement is authorised, the following procedure is adopted, the "Standard Clearing Point" regulations also applying *mutalis mutandis*. Fig. 1 represents the ordinary type double-line junction, provided with the usual cross-over road; A, B, C and D indicating the four signal cabins necessarily concerned. (1) When "line clear" has been given by B (the junction signalman) for a train to approach from C, no train must be allowed to leave D until that from C has either been brought to a stand at the junction home signal, or has passed through the junction for the standard quarter mile distance. Neither must a train from A be allowed to approach towards D unless the junction facing points are first set for C, and the line beyond them (towards C) be clear for the standard distance likewise. (2) If B has accepted a train from D, no train must in like manner approach from C until that from D has stopped at the home signal, or passed through the junction for the prescribed distance as before.

The alternate form of obstruction is provided against as follows:—(3) Should B have given permission for a train to proceed from A towards D, no train must be accepted from C until that from A has been either stopped at the home signal, or has passed clear of the junction towards D. But if the junction points be set for C, and the line beyond them unobstructed to the clearing point, then B may accept the train from C. (4) If a train has been sent through the junction points as far as the starting-signal, in either direction, and the last vehicle of such train be clear of the junction, "Line Clear" may be given for a following train, provided always that the points are first so set that the following train will pass on to the other line, and that line be also clear for the prescribed distance beyond. Assuming, however, either one of the signal boxes A, C or D to be within the quarter mile distance from B, no train in that direction must be allowed to approach B until "Train out of Section" has been received by B for the previous train from the signal box ahead, if such be within that distance, as explained.

As the reader will readily perceive, the *raison d'être* of the foregoing regulations is the possibility of an engineman overrunning the home signal. But if, as is almost invariably the case, the train be brought to a stand outside that signal, the need no longer exists for preserving the clear quarter mile space beyond. Thus signalman B, although forbidden, as before noted, to accept a train from D, when one is already approaching from C, may, nevertheless, safely do so as soon as that from C has stopped at the home signal. In such circumstances, however, the latter must be detained at that signal until the train from D arrives. Were that from C allowed to advance towards the starting signal, the portion of line between the clearing point and the home signal for D would of necessity be obstructed. By the same rule, when a train from C is checked at the home signal, trains for D from A may as noted, be accepted by the junction signalman, as is likewise the case if a train for D from A has stopped at the signal, when the acceptance of another from C is thereby legitimised.

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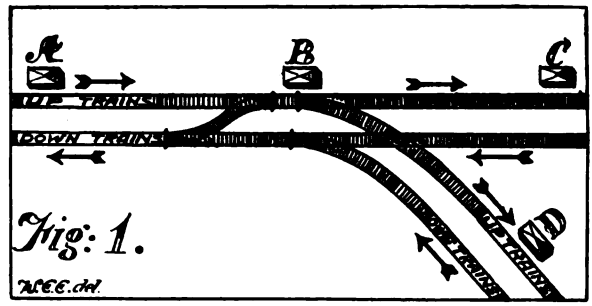
"Blocking Back."

As before stated, under standard block regulations, the "Train-out-of-Section" signal must not be sent to the rear signal box until such train has either passed the clearing point, or been shunted clear of the running line. Assuming the latter operation to be effected, and the signal transmitted, the block indication is restored to the normal or neutral position. To release the shunted train, it becomes necessary to occupy that portion of the main line which lies within the home signal, but also to the rear of the clearing point, and the fact that the block indicator exhibits neither "Train on Line" from, or "Line Clear" towards the rear cabin, allows of the operation. Thus the rear signalman is entitled, if he will, to "offer" a following train, although such would not be accepted. It is, therefore, decreed that, as long as the line be occupied by the withdrawal of the train from the loop or siding, the signalman in the rear must not only be refused "Line Clear," but must be prohibited from "asking" it. Therefore,



before the loop or siding points are altered the signalman is directed to transmit to the rear the "Blocking Back *inside* Home Signal" bell code (6 beats, thus, 2, pause, 4), which, as soon as acknowledged, is accompanied by the exhibition of the "Train on Line" signal, that indication being maintained until the usual "Train out of Section" is sent upon the passage of the clearing point by the train. This procedure is also adopted during removal of vehicles from sidings, and so forth.

Shunting, or other cause, occasionally necessitates occupation of the running line outside the protection of the home signal, involving, of course, obstruction of the rear section. Such a course is prohibited, excepting with the consent of the signalman at the rear cabin. Assuming, then, that station B has accepted no train from A (the rear station) and that the block indicators in both cabins stand at "normal," B sends A the "Blocking Back *outside* Home Signal" code (3 beats, pause, 3). A, if satisfied that he can safely give that permission, repeats the code in return, and B alters his own indicator, as well as A's, to "Train on Line," the remaining procedure being the same as in the last example.

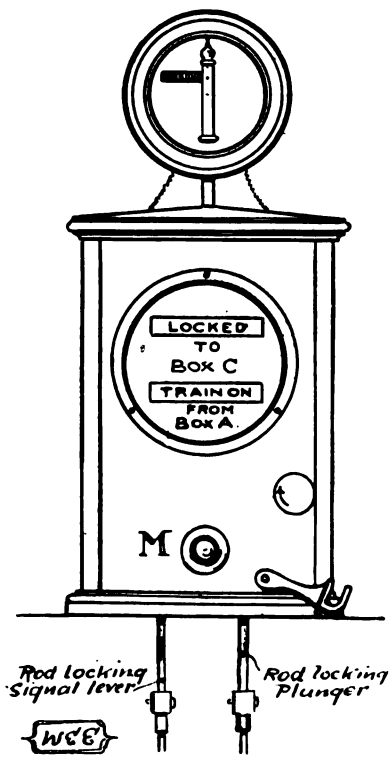


FIG. 2.

The Obstruction Danger Signal.

Cases of special obstruction, demanding the immediate stoppage of traffic from the rear station, are thus dealt with:—Six consecutive beats are sent upon the block-bell, even if "Line Clear" be already given, and that indication exhibited by the instrument. The signalman receiving the obstruction danger signal must immediately exhibit the (outdoor) danger signal, and take every measure to stop the train. The forwarding signalman places the block indicator at "Train on Line," and if necessary sends the signal in the opposite direction. This important "emergency" signal is but one among various others, which every signalman

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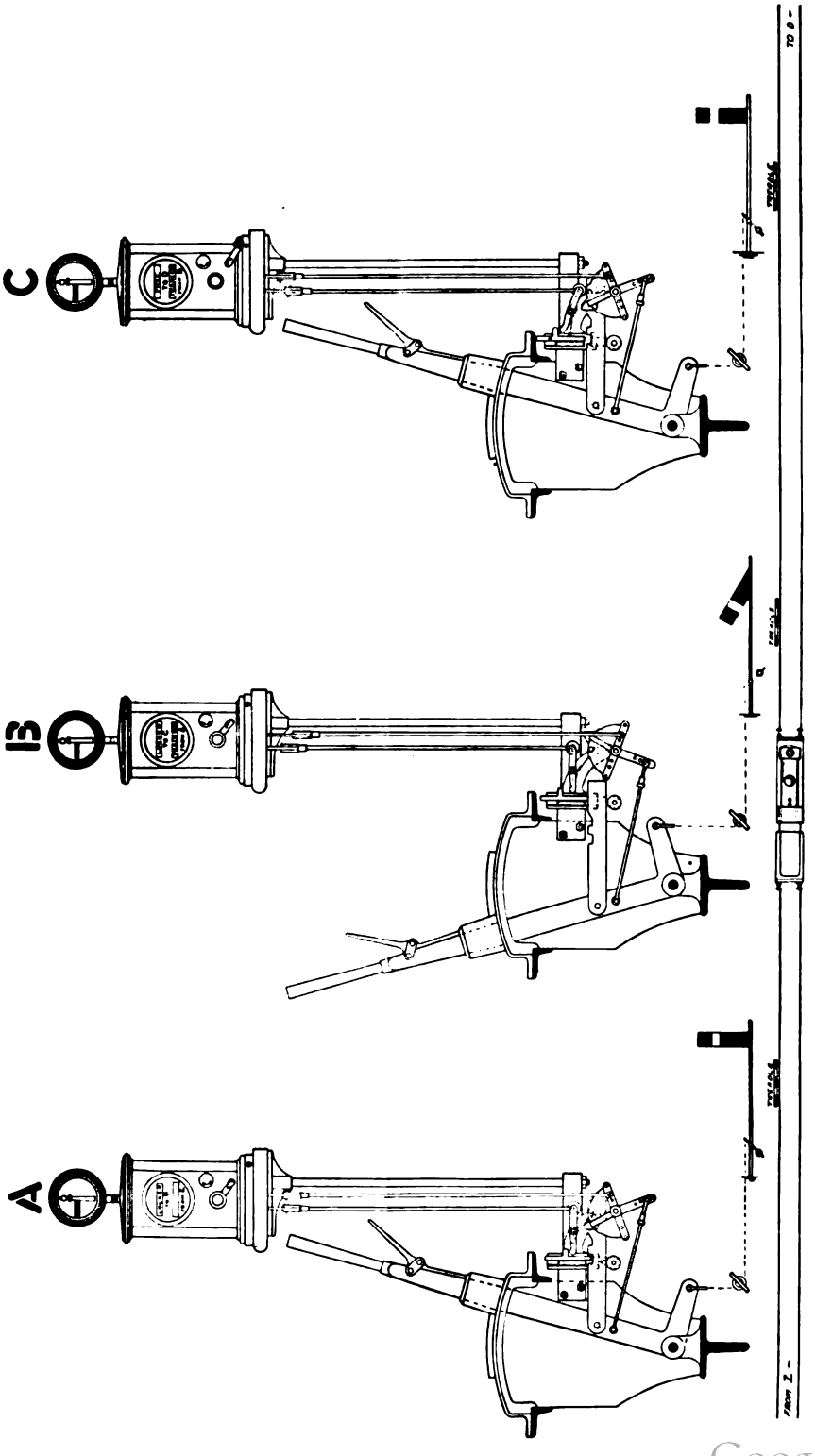

FIG. 3. SYKES' LOCK AND BLOCK INSTALLATION.

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must, at all times, be prepared to receive, and promptly act upon. A recitation of the remainder, as well as other block regulations, not dealt with, would unduly prolong the subject. Suffice it to say that they provide for every conceivable emergency, their construction being based upon practical experience, considerations of safety, in all cases outweighing, as is fitting, every other.

"Permissive" Block Telegraph Regulations.

Under given conditions, such as goods, or other auxiliary lines outside the general block scheme, a modification of the standard, or "Absolute," regulations is recognised, and is for that reason described as "permissive" block working, under which "more than one train or engine" may (under prescribed precautions) "be allowed to be in a section at the same time." A passenger train must not, however, be so admitted if a goods train be in front, nor must the latter be allowed in the section if a passenger train be already therein. The block apparatus is supplemented by a special indicator known as a "tell-tale," which records, in due order, the number of trains as they enter, or leave, the section concerned. Otherwise, the general block regulations apply, with specified modifications and additions.

Electric Interlocking, or "Lock and Block" Signalling.

Under ordinary, or "Absolute" block regulations, we have seen that, until the signalman in advance gives the requisite telegraphic consent, by means of bell-code and block indicator, the starting signal from the station in the rear is maintained at "danger," and no train is permitted to enter the section concerned. The Lock and Block system, however, goes a step further. It *compels* the signalman to operate his outdoor signals in absolute harmony with the electrical block signals. Furthermore, neither block apparatus nor outdoor signals at the rear cabin may be operated to admit a following train, until the preceding one has actually cleared the section—a condition which either signalman is powerless to alter. In other words, the starting signal and block apparatus are not only electrically interlocked, and controlled by the signalman in advance, but through the medium of further and independent electrical mechanism, technically known as the "rail contact," the train protects itself, and controls block apparatus, signals, and even the actions of the signalmen themselves.

This combination of electrical and mechanical apparatus exists in six, or more, different forms, and is applied, in several instances, to the ordinary block telegraph instruments. The most largely adopted system, however, is that of Messrs. Sykes, wherein a special type of block instrument is employed, the latter, including the remaining apparatus, being therefore selected for illustration. Fig. 2 represents the block instrument itself, the small electrical semaphore surmounting it denoting "Section Clear," or "Blocked," after the manner of the ordinary block-indicator previously referred to, excepting that the train must, as stated, have actually cleared the section before the "line clear" indication may be given. The word "Locked" appearing below (on a red ground) means not only "keep your starting signal at 'danger,'" but that "you must," for it is locked at that position by the signalman ahead. The lower indicator either presents the words "Train on," as represented, or makes no indication, as the case may be. Beneath the latter is the plunger, M, and beside it the switch

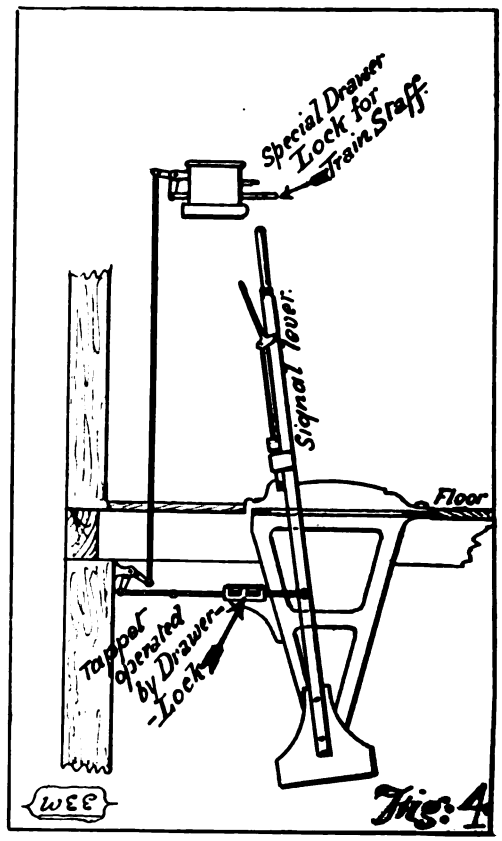

Fig. 4

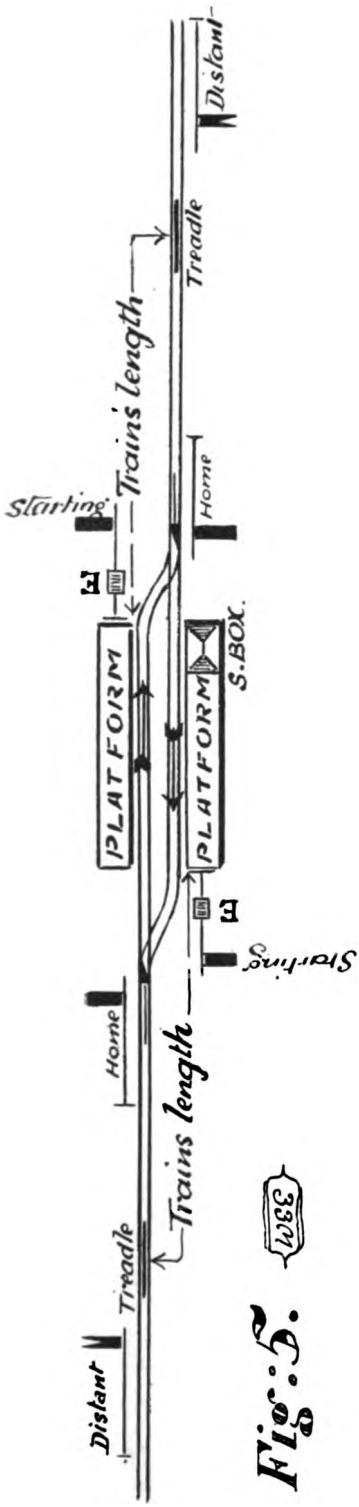

Fig. 5.

hook, which, when turned over, engages with the plunger after it has been used, and so acts as a "reminder," while in most cases, it likewise actuates the miniature block arms mentioned.

In explanation of the *modus operandi*, the reader is now assumed to be following, with the aid of diagram 3, the course of a train through two double-line block sections, past three signal cabins, called A, B and C. Signalman A has a train for B, and therefore transmits the usual bell signal. B, if prepared to accept the train, presses plunger M, and turns the switch hook, this causing the indication "Train on" to appear at the lower opening in B's apparatus, while the word "Locked" disappears from the upper opening in A's, and the indication "free" takes its place. A's starting signal is also now unlocked. A lowers the latter and the train starts for B. The same plunge on B's part also raises the semaphore over A's instrument to "Danger." The lowering of A's starting signal causes the word "Free" to disappear from his own instrument, and the indication "Locked" succeeds. A, as soon as the train has passed over the contact treadle, a train's length beyond the starting signal, puts the latter to "Danger" behind the train, and it cannot now be lowered again without B's consent.

Before B is able to lower his starting signal for the train to pass towards C, C must do for B that which B did for A. This being done, B may lower his signal, but the train must first "break down" the treadle, and the signal be raised behind the train before he can permit A to dispatch another train. It will thus be seen that under "Lock and Block" regulations there is no possibility of "more than one train being in the section between two block signal boxes on the same line at the same time," while in the case of failure of apparatus or imperfect operation on the part of signalmen, instruments and signals are alike locked up, and the line blocked. As already stated, the dominant feature is the electrical treadle, which, in position, somewhat corresponds with that of the "Standard Clearing Point" under ordinary block regulations, the apparatus having been already illustrated and described in the RAILWAY MAGAZINE (December, 1908), the deflection of the rail (to which the treadle is attached) by the weight of a train, being necessary to release the signals, and block apparatus in the rear. Such, in brief, are the principles of "Lock and Block" signalling, or, as Messrs. Sykes term it, the "controlled manual" system, and when, as has been suggested, the release of the locking is so devised as to be dependent, in all cases, upon the passage of *last* vehicle of the train, rather than upon that of the locomotive itself, it would seem that something approaching finality will have been attained in block signalling generally.

Upon single line railways, the obvious safety of the electric staff, or tablet system has already been indicated. In order, however, to make that "assurance doubly sure," the Railway Signal Co. has devised a method which provides, in effect, a single line "Lock and Block" system; that is to say, the starting signal is automatically

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put to "Danger" behind the train; it is also locked in that position, and can only be unlocked when the signalman is in possession of the train staff. Thus the "Right Away" signal cannot be given excepting under the requisite conditions, as before indicated. Fig. 4 is a sectional view showing the controlling mechanism as applied to the ordinary interlocking in relation to the starting signal lever, and Fig. 5 is a signal diagram of a passing station on a single line railway, illustrating further the methods of operation.

Upon the instrument shelf above the lever frame is placed a special drawer lock which is connected, in the manner shown, with the tappet of the lever it releases, the connecting rod being attached also to one end of the lower slide of lock. This slide is normally locked, and can only be released by the staff being placed in the drawer, which is then pushed right home, so operating the controlling mechanism in the box, and releasing the lower slide. The latter is next withdrawn, and the tappet which releases the signal lever is now so operated, that the starting signal may be lowered and the staff released by putting back the lower slide at its normal position, the signal lever being then free to be put back to "Danger," at which position it is again locked. Further reference to Fig. 5 will explain that where the sectional signals are controlled by the train staff, the passage of the train over the electrical treadles automatically places those signals at "Danger," the operation being effected by the electric "replacers" indicated at E. The signalman is, nevertheless, likewise compelled to "put back" the controlling lever.

Photo] [*R. J. Purves.*

NORTH EASTERN RAILWAY:

12.30 p.m. Newcastle-Liverpool Luncheon Car Express.

4-6-0 locomotive No. 797 (painted black and fitted with Robinson Superheater).

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Photo] [*R. B. Gamble.*

MIDLAND RAILWAY:

11.50 a.m. express *ex*-St. Pancras passing Ilkeston Junction. Compound locomotive No. 1000.

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

"THE time has come," the Walrus said, "to talk of many things." So wrote the inimitable Lewis Carroll, and this will form a suitable "text" for the present article, as the rapidly growing accumulation of correspondents' letters really demands attention. On that account, therefore, the miscellany of runs and remarks which follow will perhaps be excused by those readers who prefer a more serious discussion such as that which engaged attention last month.

Reference to last month's article reminds me of a letter from a Liverpool correspondent which reached me after the February issue of the RAILWAY MAGAZINE had gone to press. His letter, curiously enough, anticipated my subject in that issue, and furnished details of a run with a down London and North Western express from Preston to Carlisle, showing some fine work on the part of an engine of the non-superheater 4–6–0 or "Experiment" type from Carnforth up to Shap Summit. The train was the 10.51 a.m. *ex*-Preston, booked thence to Carlisle (90 miles) in 102 min. The engine, whose number my correspondent omitted to furnish, rejoiced in the name of *Britomart*, and the load was one of 5 Lancashire and Yorkshire corridor coaches, 5 West Coast Joint eight-wheelers, and a twelve-wheeled luncheon car, totalling about 330 tons behind the tender. With this decidedly heavy load for an "Experiment"—heavier, indeed, than an unpiloted 4–6–0 non-superheater engine took on any of my 14 runs tabulated last month—the smart booked time was kept exactly. The principal feature of the run was found in the climbing, which, load for load, was superior to that of any of my "Experiment" runs. On Grayrigg bank the minimum speed was 33 miles per hour, while up Shap incline, where a severe storm of rain and wind was encountered, and the engine began to slip, the slowest quarter-mile took 37 sec., a minimum speed of 24.3miles per hour. The total time from Carnforth to Shap Summit was 43 min.—a better time than that of all my runs behind "Experiments" with loads exceeding 200 tons, but inferior, by from 2 to 2½ min., to those of the

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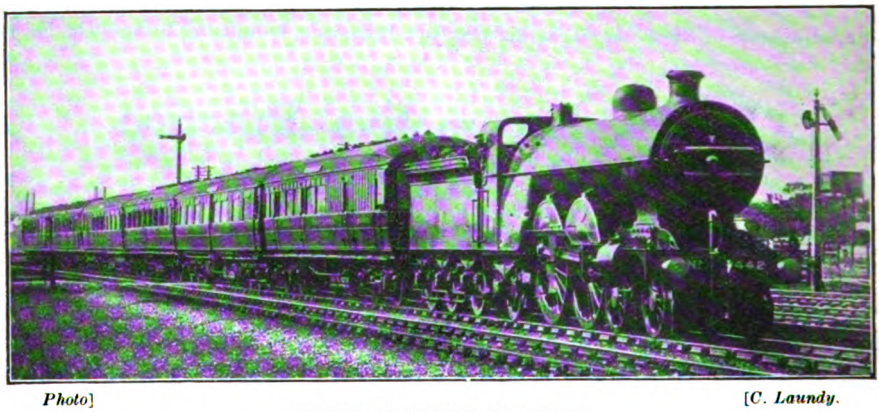
three runs with superheater engines hauling the same loads, as well as 3 min. in excess of schedule. But still, this must have been a very fine run, and one that I should have valued the opportunity of timing personally in greater detail.

Among other points mentioned in the letter I note that Lancaster, 21 miles, was passed in 24 min. from Preston—an excellent time, although substantially beaten by my run with the 4–4–0 superheater *Cyprus*, hauling 350 tons, which only took 23 min. 5 sec. My correspondent also desired to make the uphill running appear still better than it was by citing the distance from Carnforth to Shap Summit as 32½ miles, whereas it is only 31½ miles, and he then gave the distance from the summit to Carlisle, which occupied 30 min., as 30 miles, instead of 31¼ miles. He remarks that the descent was very cautious, speed being kept below 65 miles per hour until the train was near the foot of the bank, but that very fast running was made on the succeeding stretches. As the foot of the bank is in reality Carlisle itself, the meaning of this statement is wrapped somewhat in mystery, but the presumption is that the running was at moderate speeds until after the level stretch through Penrith, and then fast beyond, as is often the case. If the details given were really accurate—this implies not the slightest reflection on my friend's veracity, but one could wish, as I said, for a little amplification of the matter supplied—this "Experiment" run ranks as but little inferior to those with the superheater engines that I gave in the last issue.

Having thus arrived at a point so near the Border, I will proceed to the communication of a Paisley reader, who writes: "It is not often that we have logs of Scotch trains in the RAILWAY MAGAZINE," and proceeds to recount two recent experiences of his own. The first, one from Edinburgh to Glasgow by the Caledonian route, is not of particular interest as, with a very light load, time was lost on an easy booking. In the reverse direction, however, my correspondent travelled by the North British route, and his log is worthy of record. The train was the 4.0 p.m. *ex*-Queen Street station, Glasgow; the load one of eight eight-wheelers, and one twelve-wheeled restaurant car, totalling 310 tons. Such a load is fairly heavy for this stretch of line, and it was hauled by one of the latest 4–4–0 engines, No. 360, *Guy Mannering*. The train was presumably piloted to Cowlairs, as a special stop was made there, evidently to detach the pilot. This initial 1½ miles up Cowlairs bank took 6 min. Re-starting from Cowlairs, the 4¾ miles to Lenzie were covered in 8¾ min., the 6½ miles thence to Dullatur in 7½ min., and the 12¼ miles from that point to Polmont, over an almost level track, in exactly "even time." The 26 miles from Cowlairs to Manuel, start-to-stop, took 31¼ min., with a maximum speed of 66 miles per hour near Castlecary. After leaving Manuel a special stop was made at Linlithgow, the 2¼ miles between these points taking 5 min. and the 16¼ miles from this stop to that at the Haymarket took 20½ min. A 3¾ min. run from the Haymarket to the Waverley Station at Edinburgh gave a total journey time of 73 min. against 67 min. scheduled, although the run included



Photo] [*C. Laundy.*

GREAT NORTHERN RAILWAY:

2 p.m. up express from Leeds (non-stop from Wakefield). 4–4–2 locomotive No. 1442.

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two special stops. The weather was wet and foggy.

In comparison, I might mention a couple of really fine runs which I timed during the past month over the same length of line behind two of the earlier 4–4–0 engines of Mr. Matthew Holmes' design. In the first instance the engine was No. 318, and the train one of six eight-wheelers and two twelve-wheelers, totalling 280 tons, thus but little inferior to the load of my correspondent's run. We took 7 min. 25 sec. even with the aid of a pilot, to reach Cowlairs, but did well from that point, passing Lenzie in 8 min. 50 sec. and Dullatur in 16¾ min. Dullatur to Polmont occupied 13 min. 5 sec.; the 7¾ miles, Polmont to Philpstoun, 8 min. 5 sec.; and the 11 miles thence to Saughton 10¾ min., with a maximum speed of 64·3 miles per hour near Gogar. The total time for the 44¼ miles from Cowlairs to Haymarket was 51½ min., showing remarkably good work for so early an engine, with times but fractionally inferior to those of the powerful 4–4–0 just given. From Queen Street to Waverley the total time of 64 min. 20 sec. showed an economy of nearly 1¾ min. on the 66-min. booking. The total distance is 47¼ miles, and stops were made at both Cowlairs and Haymarket.

A very similar and an equally good run was performed by No. 730 on the recently accelerated 4.0 p.m. train from Edinburgh to Glasgow, which now is booked to complete the journey, with one stop (at Haymarket), in 63 min. On this occasion the load was lighter, consisting of six eight-wheelers and only one twelve-wheeler, or 240 tons in all; but a strong north wind, with driving snow, did not tend to help matters. Waverley to Haymarket took 3¾ min. and a moderate start was then made, Gogar, 6¾ miles, being passed in 11 min. 20 sec., Winchburgh, 10½ miles, in 16 min. and Linlithgow, 16 miles, in 22 min. 10 sec. Most of this distance is on faintly rising grades. From Linlithgow a very even speed was maintained. The 8 miles to Falkirk took 8 min. 5 sec., the 9 miles thence to Dullatur 9¼ min. and the 9½ miles from that point to Bishopbriggs exactly "even time." Cowlairs, 44¼ miles from Haymarket, was passed at about 5 miles per hour in 51½ min. Queen Street, after a slow descent of the bank, was reached in 61 min. 40 sec. from Waverley, against the schedule of 63 min. These records will show how comparatively easy of achievement, even with engines of earlier types, is the 60-min. non-stop booking which was in force during last summer by the "Lothian Coast Express"; and one is tempted to wonder whether, considering the importance of the traffic between the two cities, a regular 60-min. service at more frequent intervals, with somewhat lighter trains than at present, might not prove a profitable innovation. A sixty-minute schedule would allow of at least one stop, and perhaps two, with lighter trains, and with a more frequent service the existing stops could be spread over the various trains in such a way as not to curtail the facilities now enjoyed by intermediate towns.

One point which has struck me very forcibly in connection with the communications I have received is that in almost all cases they direct attention to the work of 4–4–0 engines and in several instances to that of comparatively early types. In contradistinction to the performance of the latest superheater engines, which have been considered during the last two months, the comparison is decidedly interesting, although it will be noticed that, in most of the cases where sustained high speed is cited in the runs here given, the loads hauled were necessarily light, as compared with those that the modern superheater 4–4–0's, 4–4–2's and 4–6–0's are able to tackle.

A valued correspondent at Scarborough, however, dives still further into antiquity by forwarding details of a run on the North Eastern Railway from York to the "Queen of the North-East Coast." My friend, who has timed a good many runs over this "course," and has had what might not inaptly be described as a "bogey" in the matter of time for some years past, was delighted recently to find all his previous start-to-stop records substantially beaten by a small 2–4–0 engine of the 901 class—No. 329—hauling a load of four eight-wheelers, or 105 tons. The train was the 6.3 p.m. *ex*-York, booked non-stop over the 42 miles to Scarborough in 50 min., although this time includes reductions of speed to 45 miles per hour over 5 miles of sharply curved line between Barton Hill and Huttons Ambo, through Malton station, and over a further sharp curve near Seamer. On this occasion Haxby, 4¼ miles out, was passed at 58·4 miles per hour in 6 min. 50 sec. from the start and the speed then rose to a maximum of 65·2 miles per hour on the slight descent at 1 in 264 to Barton Hill, the 7¼ miles

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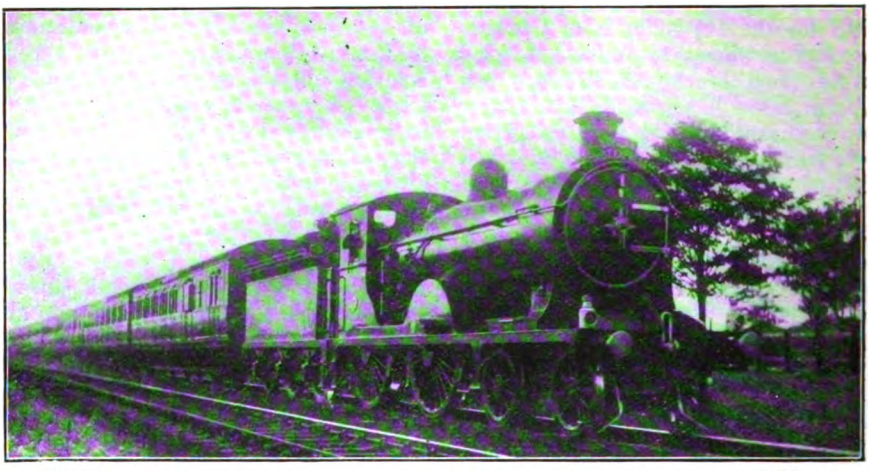
from Haxby to this point taking 7 min. 20 sec. Speed was reduced, but not very substantially, over the 5 miles of curves, and with a maximum of 60·8 miles per hour touched just before Malton, the 9½ miles from Barton Hill were completed in 9 min. 43 sec.; the total time for the 21 miles from York to Malton was thus 23 min. 53 sec. Accelerating rapidly from Malton slack up the faint rise to Rillington, Knapton, 6½ miles further, was passed in 7 min. 7 sec. and the 7 level miles from that point to Ganton were covered in 6 min. 50 sec. with a maximum speed of 63·3 miles per hour near Weaverthorpe. Running into Scarborough rather more briskly than usual, the last 7½ miles to the dead stand occupied only 8 min. 40 sec., so that the whole 42 miles from York had actually been covered start-to-stop in 46½ min. On this very fine run, therefore an economy of as much as 3½ min. had been effected on schedule time, giving an average speed, with the slacks, of 54·2 miles per hour.

On the same train, with the same engine and load, I had myself during last month a run which in certain particulars showed an improvement even upon the foregoing, although not giving so good a total time. In my case the start from York was noticeably more brisk, Haxby being passed in 6 min. 20 sec. at a fraction over 60 miles per hour, while a speed of 63·4 miles per hour was sustained for some miles beyond this point. The same time as before was occupied from Haxby to Barton Hill, but after attaining 64·3 miles per hour just beyond the latter station, a much more careful observance of the long service slack was made, so that we took 11 min. 12 sec. from Barton Hill to Malton, passing that town in 24 min. 52 sec. from York. Again a smarter acceleration from Malton slack than on the previous occasion was recorded, a speed of 60 miles per hour being attained before Rillington, while Knapton was passed in 7 min. from Malton. From this point to Ganton the speed was not so high as previously, the distance taking 7 min. 13 sec. while the approach to Scarborough was also slower, 9 min. 17 sec. being consumed on the 7½ miles from Ganton to the stop. This gave a total time of 48 min. 22 sec. (still more than 1½ min. under schedule), but with a similar observance of the speed restrictions the two runs would have been practically identical in total time, the faster running of the first beyond Malton balancing the smarter start of the second from York.



Photo] *J. Cheyne.*

NORTH BRITISH RAILWAY:

Lothian Coast Express (3.50 p.m. *ex*-Glasgow) near Lenzie. Locomotive No. 895 *Rob Roy*.

With a load of 115 tons, No 329 also gave me an excellent run in the reverse direction two days later. Again we enjoyed a very smart start, the three downhill miles from Scarborough to Seamer being covered in 5 min. 5 sec. while some high speed followed on the faintly falling grades beyond. Weaverthorpe was passed at 68·1 miles per hour, and the 9¾ miles from Seamer to Heslerton were covered in 9 min. 20 sec. That is to say, 12¾ miles from the start had been completed in 14 min. 25 sec. The 8¼

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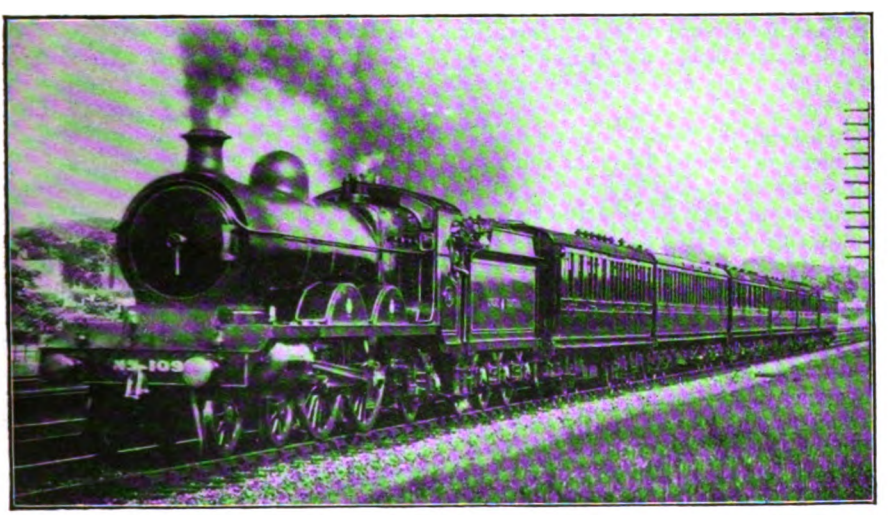
miles from Heslerton to Malton stop were covered in 8 min. 47 sec., giving the wonderfully smart time, for a 21 miles' run, of 23 min. 12 sec. start-to-stop, against a schedule of 24 mins. With a reduced load of 105 tons from Malton, the curved stretch of line was taken at moderate speed, and Barton Hill, 9½ miles, was passed in 12 min. 35 sec. From that point the 7¼ miles to Haxby took 7½ min. and the last 4¼ miles into York 5 min. 25 sec. This afforded a running time of 25½ min. for the 21 miles from Malton to York, 2½ min. under the 28 min. allowed. The aggregate running time for the two stretches (Scarborough—Malton and Malton–York) was thus 48 min. 42 sec., equivalent to a non-stop time of certainly not more than 46½ min. in this direction also.

allerton, 30 miles, in 33 min. 20 sec. from York, after a slow approach. The second run was much finer, although the start was of an easier character, 12½ min. being occupied on the run to Tollerton. At this point, however, our driver had succeeded in attaining a speed of 68·1 miles per hour on the level—surely a remarkable feat for an engine of this comparatively early type. On the slightly adverse grades beyond to Thirsk the speed never fell below 64·3 miles per hour. Pilmoor, 16 miles from York, was passed in 18 min. 25 sec.; Thirsk, where the speed had again risen to 68·1 miles per hour, in 24 min. (22¼ miles); and Otterington, 26½ miles, in 28 min. 5 sec. Thus the 16¾ miles from Tollerton to Otterington had been covered in the sur-



Photo] *C. Laundy.*

GREAT CENTRAL RAILWAY:
3.15 p.m. down express (non-stop to Sheffield). 4–4–2 locomotive No. 1093.

Thus No. 329 is performing really excellent work on this branch, well worthy of careful observation.

On the main line, too, an engine of the same class has recently been affording me some excellent runs, the particular locomotive in this case, strange to relate, being No. 929, not No. 329. The train was the recently instituted 9.20 p.m. express from York to Saltburn, conveying the through coach which leaves London attached to the 5.30 p.m. down, and made up usually to four eight-wheelers, or 110 tons. On the first occasion No. 929 passed Tollerton, 9¾ miles from York, in 12 min. 10 sec. covered the 12½ miles thence to Thirsk in 12 min. 5 sec. and stopped at North-

prising time of 15 min. 35 sec.—the grades, though very slight, being entirely adverse to the engine—and the total time from York to Northallerton was 32½ min., 1½ min. under the schedule time of 34 min.

Another recent run which I have had in the same direction, had its principal feature centred in the fact that the load consisted of one coach, and the engine was a "foreigner." The train was the 5.45 p.m. *ex*-York, which during the winter months generally consists only of the through West Hartlepool coach of the 1.40 p.m. express *ex*-King's Cross; and, in order to balance engine workings between Doncaster, York and Harrogate, it is worked by

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a Great Northern locomotive to Thirsk, the latter then returning "light." In this instance the engine was a 4–4–0, class W, No. 1,376, and the load one solitary twelve-wheeler, weighing with passengers a modest 40 tons. The engine started out cheerfully to break every record I have made to Beningbrough, covering this initial 5½ miles in 7 min. 20 sec. But from that point forward the speed was—fortunately for the passengers—very far within what the engine might have afforded had very fast running been necessary. No greater rate than 66·2 miles per hour was attained at any point. Alne, 11¼ miles, was passed in 12 min. 50 sec.; Pilmoor, 16 miles, in 17 min. 20 sec.; Sessay, 18 miles, in 19 min. 10 sec.; and we should have stopped comfortably at Thirsk in 24 min. but for a check south of the station. Even then we ran right through, and stopped in the yard north of the station, ready to shunt back, in 25 min. 40 sec.—more than 1¼ min. under schedule time.

Before leaving the North Eastern Railway I must mention another very fine run which I secured the other day behind a heavily-laden engine of the R1 4–4–0 type, No. 1,238 (now superheated), which is well worthy of record. I was coming south on the 10 a.m. *ex*-Edinburgh, the load from Darlington consisting of six twelve-wheelers and five eight-wheelers, totalling 56 axles, and weighing, with a very heavy load of passengers and luggage, at least 405 tons. Yet with this tremendous train the 5¼ miles from Darlington out to Eryholme Junction were cleared in 8 min. 5 sec. although the last 2¼ miles of this distance are inclined upwards at an average of 1 in 366. On the faintly falling grades beyond a maximum of 63·4 miles per hour was touched at Danby Wiske, followed, after a brief lapse to 60 at Northallerton, by a sustained stretch at 68·1 near Thirsk. A slightly more moderate rate again intervened until on the 1 in 805 near Alne we managed to touch 70·3 miles per hour—an excellent feat, with such a load. Northallerton, 14¼ miles from Darlington, was passed in 17 min. 10 sec.; Thirsk, 22 miles, in 24½ min.; Alne 33 miles, in 34 min. 35 sec.; and Skelton Bridge box, 41⅛ miles, in 42 min. 10 sec. For the 26⅞ miles of but little easier than level track from Northallerton to Skelton Bridge 25 min. was a smart time with 405 tons, especially as a strong east wind made itself felt on unexposed stretches of line. With a quick finish into York—the train was running behind time—the journey of 44¼ miles from Darlington to the Minster city was completed in exactly 46 min., or 3 min. clear under schedule time. The feat was all the more noteworthy in view of the fact that the engines which subsequently took over the haulage of the train—with the addition of but one bogie coach—managed between them to lose a clear 19 min. to King's Cross, irrespective of traffic and permanent way delays.

I am indebted to two correspondents who furnish details of runs on the Great Northern Railway of Ireland, where excellent performance may be witnessed over a none too easy road. Out of Dublin the first 32 miles to Drogheda undulate at comparatively moderate grades. Immediately following, however, there is a 4½ miles climb at 1 in 166–177 to Kellystown summit (327 ft.), succeeded by a fall for 5½ miles at easier grades to Dromin. Beyond Dundalk where, between Adavoyle and Bessbrook, the western spurs of the Mourne Mountains are crossed at an altitude of 522 ft., some very heavy grades are experienced, the southern approach being inclined for some 10½ miles at an average of from 1 in 91 to 1 in 140, and the steeper northern approach for 8½ miles, principally at 1 in 105. From Dundalk to Goraghwood, therefore, the line is really difficult in character, although beyond the latter point the undulations are but moderate throughout to Belfast. The worst service slacks in force are those through the two adjacent stations of Poyntzpass and Scarva, between Dundalk and Portadown, to 30 and 20 miles per hour respectively, while two others to the latter figure are enforced on north-bound trains at Portadown Junction, and on south-bound trains over the well-known Boyne Viaduct at Drogheda. The latter restrictions, however, being comparatively near the station stops, do not constitute any material hindrance to fast running.

The first run forwarded to me relates to the 3.30 p.m. express from Dublin to Belfast, booked over the 31¾ miles to Drogheda in 43 min. and on the occasion mentioned one of Mr. Clifford's large 4–4–0 engines, No. 113, *Neptune* had to deal with a load of eight eight-wheelers and three six-wheelers, the 41 axles totalling in weight 260 tons behind the tender. From Amiens Street to Howth Junction the 4¾ miles occupied 9¾ min. and the 4¼ miles from that point to Malahide 4¾ min., while the

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initial 11½ miles to Donabate were covered in 17 min. from the start. On the up grades thence to near Skerries, much of which are at 1 in 173, a good speed was maintained, the 6½ miles from Donabate to Skerries being covered in 9 min., while the succeeding 9 miles to Laytown occupied only ¼-min. more. As this initial 27 miles from Dublin had been covered in 35¼ min. the finish of the run was apparently slow, as the last 4¾ miles into Drogheda occupied 7¾ min. giving a total time for the journey exactly corresponding to schedule. There is only one faster booking than this in the north-bound direction—that of the morning breakfast car Limited Mail express from Dublin to Belfast, which accomplishes the journey in 40 min. The same letter mentions a return run, on which 4–4–0, No. 157, *Orpheus*, again hauling 41 axles (250 tons), covered the 22¾ miles start-to-stop from Drogheda to Malahide in 28¾ min.—quite praiseworthy work with a very fair load.

My other correspondent forwards details of a finer run throughout from Belfast to Dublin by the 5.0 p.m. Limited Mail express, which boasts the fastest south-bound schedule on the system. In this instance the engine was sister—or rather brother—to that employed on the north-bound run just mentioned, being numbered 114 and styled *Theseus*. From Belfast to Portadown the load was one of five eight-wheelers, one twelve-wheeled dining car and two six-wheelers, and beyond Portadown one eight-wheeler less, representing 32 axles (205 tons) and 28 axles (180 tons) respectively. The start out of Belfast was not startling, the initial 7½ miles to Lisburn taking 14 min. 20 sec.; but the 7 miles thence to Moira were covered in 7¾ min. Good running was made over the ensuing 9¼ miles to Seacoe Box, which occupied, 9¾ min., and Portadown 25 miles from Belfast, was reached in 34 min. exactly, against a schedule of 35 min. From Portadown the start with the reduced load was rather less sluggish, the 5½ miles to Tanderagee taking 9 min. 35 sec., while the 7½ miles from that point to mile-post 74½ wer covered in the excellent time of 8¾ min., although the distance includes the severe slacks at both Scarva and Poyntz-pass. Mile-post 74½ marks the foot of the long ascent previously referred to, and the 9 miles to mile-post 65½, which is adjacent to the summit, occupied 15 min. 40 sec. the speed up the 1 in 105, with only 180 tons, averaging the not very brilliant figure of 27 miles per hour. Beyond the summit a studiously moderate rate was maintained over the 10½ miles of falling grades to Brick Works Siding Box, outside Dundalk, taking

Photo] [*R. J. Purves.*

NORTH EASTERN RAILWAY:

10 a.m. up express from Edinburgh to London. 4–4–2 locomotive No. 728 (Schmidt superheater).

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no less than 11 min. so that the total time for the 33¼ miles from Belfast to Dundalk, scheduled 45 min., showed a loss of 1 min. 20 sec.

South of Dundalk improved work was performed. Mile-post 50, 4¼ miles from the start, was passed in 7½ min., and the 6½ miles from that point to Dromin Junction were covered in 7 min. The 6 miles of adverse grades from Dromin to Kellystown summit occupied 8 min. 40 sec. and the 5¾ miles thence into Drogheda, again with moderate downhill speeds, 6 min. 40 sec. This yielded a total time of 29 min. 50 sec. for the 22½ miles from Dundalk to Drogheda —an economy of 10 sec. on schedule. The best work of the journey was performed beyond Drogheda. Starting well, the 4¾ miles to Laytown were covered in 7 min., the 5¼ miles thence to Balbriggan in 6 min. 10 sec. and the 7¾ miles to Rush and Lusk in 9 min. 5 sec. Fast running ensued, as a maximum speed of 69 miles per hour was touched, and only 8¾ min. were consumed from Rush to Howth Junction, 9¼ miles. The 30 miles from Drogheda to Clontarf were covered in the excellent time of 34 min. 25 sec. and the train reached Amiens Street in exactly 37 min. from Drogheda, this gain of two min. on the booking involving an average speed over the last stretch of almost exactly 50 miles per hour. The runs given in this issue, therefore, cover the work of 4–4–0 engines in the three countries of England, Scotland, and Ireland, bearing testimony to the universally excellent results that are still obtained from the use of locomotives of this wheel arrangement. Next month I hope to deal with experiences of both correspondents and myself in the south and west of England.

Errata will, alas creep into one's literary efforts, although they seldom escape the lynx-eyed attention of readers. A friend has kindly written to notify the discovery of such an error in my article in the last issue, where "Carlisle to Warrington," in the second paragraph, should obviously read "Crewe to Warrington." As I was dealing with the down journey throughout, I hope that no reader will have been misled by this unintentional slip.

At the commencement of the second paragraph of page 128 *Bonaventure* should obviously read *Defiance*.

Photo] [*A. J. F. Bond.*

TOTNES: GREAT WESTERN RAILWAY.

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Leaves from the Log of a Locomotive Engineer.

[No. VI.]

By ROBERT WEATHERBURN.

A BRIEF description of Cronstadt may not be out of place as part of this personal record. The Gulf of Finland, at the end of which lies Cronstadt, is formed by Esthonia on one shore, and Finland on the other. The bay of Cronstadt is shallow, dredging being continuously needed, in order to keep open the passage for warships. Here and there mighty fortifications are reared, as it were, sheer from the water. Peter the Great recognised the value of the Kotlinoi Ostroff, and built the stupendous Konshlott. Paul bristled the rock of Riesbach with cannon. More modern forts stand up colossal and menacing in all directions. Armour-clad walls, through which peep the Krupp cannon, seem to effectually prevent the entrance of a hostile fleet. A profound feeling of surprise is experienced by the stranger at the enormous outlay of labour and money to protect the waterway to St. Petersburg. The sum has been variously estimated at 1,200 millions and 1,800 millions of roubles, or about 240 million pounds sterling; but this I believe to be considerably under the mark. The number of cannon mounted is really known only to the Commandant, but nearly 4,000 are ever ready to defend the entrance to the proud city of Peter.

The harbour is replete with convenience, and 50 vessels of war can float landlocked. Another harbour for commerce is capable of holding 1,000 ships. Canals intersect and connect the various moles and havens. In whichever way you look, wherever the eye rests—from the fertile shores of Esthonia, and wooded lands of Finland, still further up and through the gulf—the beetling fortifications, the palatial residences, the moles, havens, canals, the fleet, the distant city of palaces, the swamps reclaimed, one and all testify to the genius of the mighty Peter. Our steamer ploughed its way to the city of palaces.

Passing a low-lying swampy coast, in some instances wooded, with the deep autumnal colours of the pine tree, mingled and lightened of their sombreness by the silvery beech, I at length saw a sheen of reflected light, and was informed that yonder was the city of Peter the Great. Certainly no more beautiful sight could be seen when, on nearer approach, the river narrowing, yet still majestic, shows to great advantage, the splendid piles of buildings, built nearly to the waters' edge, while the roofs of the mosque-like churches, bespangled with zinc, or resplendent with silver and gold, shone with a dazzling lustre. The appearance of all Russian towns from a distance is exceedingly dazzling, owing to the profuse use of metal in covering the churches and public buildings.

Amid vociferations and hoarse shouting, we at length moored alongside the Quay of Wassili Ostroff (one of the islands on which St. Petersburg is built). The babel of tongues, in various languages, had almost a bewildering effect. From this I was aroused by the Customs officials, who, seizing my trunks and boxes, and demanding my passport, led me to their superior. The examination was pretty "stiff," and it included the smelling and tasting, by a lot of dirty-handed persons, of certain jars of preserves and plum cakes which I had taken in my baggage, and it was not exactly amusing to see the hasty and indiscriminate manner adopted in repacking these innocent articles.

Heavy boots and plum cake, preserves, writing paper and ink, well ironed white shirts and collars, neckties crammed into coat sleeves—all that had taken weeks to carefully pack and stow away—were bundled in a mass into box or trunk, the gaping lids of which, failing to reach the lock by some inches, seemed to remain open-mouthed in silent protest against such ill usage. Afterwards the dirty hands were held out for "Natchi," or tea money—an institution of which I soon knew more. The quarrelling of the *Isvostchiks*, or cabmen, who, like sharks, had already scented their prey,

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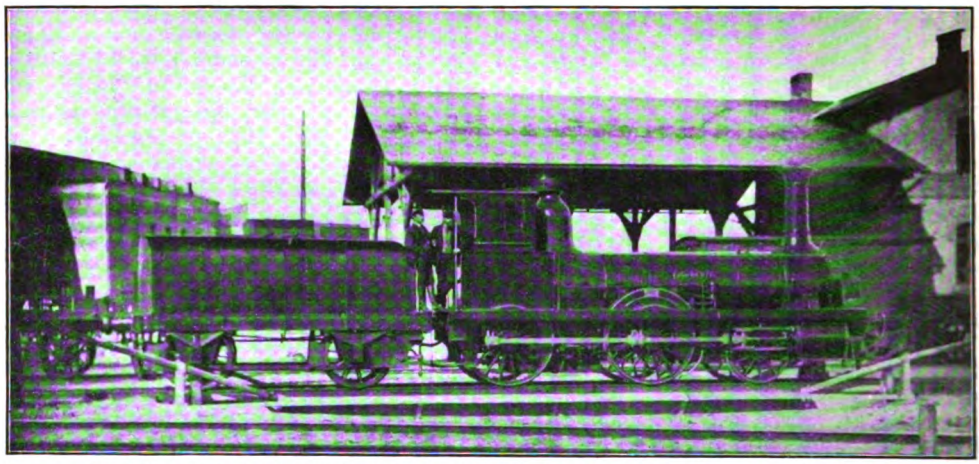
would at any other time have been intensely comical. After some trouble, I succeeded in getting the lids of my boxes closed, but not until plum cake and boot heels, burst preserves, white shirts, ink, castor oil and pills, were all commingled in one glorious state of democracy! Half an hour later found me in the English hotel, where, after recounting my troubles, I was laughed at, the experience being of nearly every day occurrence.

The city of St. Peter the Great merits a longer description than is here possible. Recovered from a mass of swamps and morasses, that were once regarded as irreclaimable, the land now contains one of the most brilliant cities of Europe. The uncommon number of palaces and churches, priests and soldiers—the two latter always a continental mixture—the splendid canals and truly magnificent bridges, the Columns of Victory and many unequalled statues, the Admiralty and Winter Palace, Hermitage and Nevski Prospekt, the watch towers, and fire stations, splendid theatres and Opera House, the scores of barracks, and multitude of soldiery, nobles, peasants, and, above all, the Foundling Hospital, fully justify.

After some weeks had passed, rains set in, with occasional storms of snow and hail. The autumnal sky, cloudless as that of Italy, gave place to a leaden-hued firmament, speedily followed by the *Malinki Moross*, or "Little Winter." Then I realised for the first time the approaching isolation of Russian life. The taking in pieces of the bridge of boats, the clearing of all ships and river craft, the putting in of double windows, storing of fuel in immense quantities, buying in of vegetables, and burying them in sand in the cellars—all was activity and bustle for the advent of King Winter, and woe betide the unfortunate, who has not the means, or will, to make such provision! Huge masses of ice floated seaward from Lake Ladoga.

The quays are deserted, snow is falling. But you can see no apprehension, for as long as the peasant has a good sheepskin coat, and the wherewithal to buy his vodka, or native brandy, he is utterly indifferent, or appears to be so. Nevertheless the "Little Winter" has come. The droshky and other wheeled vehicles have been transformed into sledges; the humble sheepskin and costly fur coats are donned, the Astrachan and Siberian furs recommence their rivalry.

Again a sudden visitation of fine weather for a few days, to give place to the *Bolshoi Marros*, or "Big Winter," the snow falls for a considerable time, and is succeeded by frosts so severe as make the hands involuntarily seek the ears and nose. Then comes the sledge and the jingling of its bells, the cries of the coachmen, the merry laugh of the ladies, who, clothed in furs, with



A LOCOMOTIVE BUILT IN THE 'SIXTIES BY MESSRS. R. STEPHENSON & CO. FOR THE RIGA AND DÜNABERG RAILWAY.

Designed by Mr. Harry Furness, the inventor of the Furness lubricator. These engines became much too light for the increasing traffic, but were remarkable for the phenomenal life of fireboxes, tubes, &c.

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bright eyes peeping from under their Basiliks, love sleighing. "Pashol Scorri Brosthep," they cry: "go faster, go faster," while the sledge flies like the wind, dashing along, turning adroitly. "Beregrissa," cries the coachman, as he dashes among the crowded vehicles, "Padye, Padye"—"make way, make way"—until he is lost in the distance. Many a night have I sat at my window by the Novo Kalinken Most, gazing with pleasure, not unmixed with envy, at the splendidly caparisoned horses and Troikas, or three-horse sledges, as they galloped by like the wind, on their way to the winter conservatory, the jingling of their silver bells ringing on the still night air, the merry laugh of the ladies who have gone to spend the midnight hours in dance and revelry, for winter is the time of enjoyment for the upper classes. All this appeared like some beautiful dream.

As an employer of labour, I had special facilities of knowing the labouring classes. Among them I have found some of the most hard-working men, but others, notoriously idle. But all more or less ignorant of the laws of *meum* and *teum*, necessitating, in all Government factories, and workshops, and mills, the careful searching of their persons. I believe this accounts for their being also politically dishonest. Whether it be from the great cold, from scarcity of water in winter, or a habit born of the people, I am unable to say, but assuredly the doctrine of cleanliness is not there understood. You may perchance meet with Petroff going to church on a Sunday or a "Preisnik" (holiday) with the dirt partly removed from his face, the natural colour of his skin showing feebly through. But do not suppose that Petroff or Ivan is ignorant of water. We must not forget that the greatest of all luxuries is a Russian bath, which every Russian frequents once every two months, at least. Meantime his epidermis is kept free from soap and water. By nature good-tempered and slothful, and, as I found, indifferent to pain and suffering, he meets the difficulties of life in a wonderfully easy manner.

It was often my wish to have been able to take the late Sir Wilfred Lawson through the Russian capital on a Bolshoi Preisnik. Men, women and children, all more or less intoxicated with vodka at a penny per glass, and a piece of dried mushroom to flavour it, leave all earthly care behind, and, like the Chinese opium eater, revel in a state of blissful inebriation. But do not suppose that vodka reigns supreme. Its sway is divided with the traktir, or tea house. I drank the best tea I have ever tasted, in Russia. Imagine a large house with enticing portico, supported by yellow painted lintels and the sign in flaming letters above, tables and chairs in profusion, and the waiter, in belted caftan, there ready. "Davai Tchai," you say. The waiter answers, "Si Tchas," the equivalent for "directly," and he speedily deposits a small tea pot, sugar and tea on a plate. The water is boiling in the numerous samovars, or brass urns, in which burn charcoal fires. Having brewed the "cup that cheers but not inebriates," we turn round to observe our numerous neighbours, to note their ways, for here, in the traktir, you meet with the Russian in his dignity, should he be a peasant, merchant, or noble. Carefully filling his saucer to the brim, he selects a piece of lump sugar no larger than a small nut, and holds it between the teeth. Then, lifting the saucer with both hands, he applies it to his lips, still holding the sugar between the teeth, through which he sips his tea. At the railway buffets the tea is usually served in glasses, flavored with a slice of lemon.

To relate my experience in St. Petersburg would require more space than can be spared. Therefore, my winter campaign being nearly over in St. Petersburg, I must away to Courland. I started from the Nicolai station with a ticket for Riga, where it was necessary to make preparations for the summer campaign. My first journey by railway was made in midwinter, and arriving at Gatchina, where Peter the Great had won a great victory, I had the opportunity of looking at my fellow passengers, who certainly did not seem to relish the cold weather in unwarmed carriages. After a tedious journey, I arrived in Riga, formerly a German town, and now speaking the best German in Europe. Conquered first by the Poles, then by the Swedes, and a third time by the Russians, under Peter the Great, it possesses more privileges than any other city in Russia, since at its capitulation Peter granted its inhabitants the power to hold property for themselves and heirs for ever. Their religion is Lutheran, and I may say that a Rigenser considers himself, as he is justly, the salt of Russia. The greatest names in Russian modern history are Riga born. Todleben, the defender of Sebastopol; Schweinfurth, — the renowned African traveller, are numbered among its native heroes.

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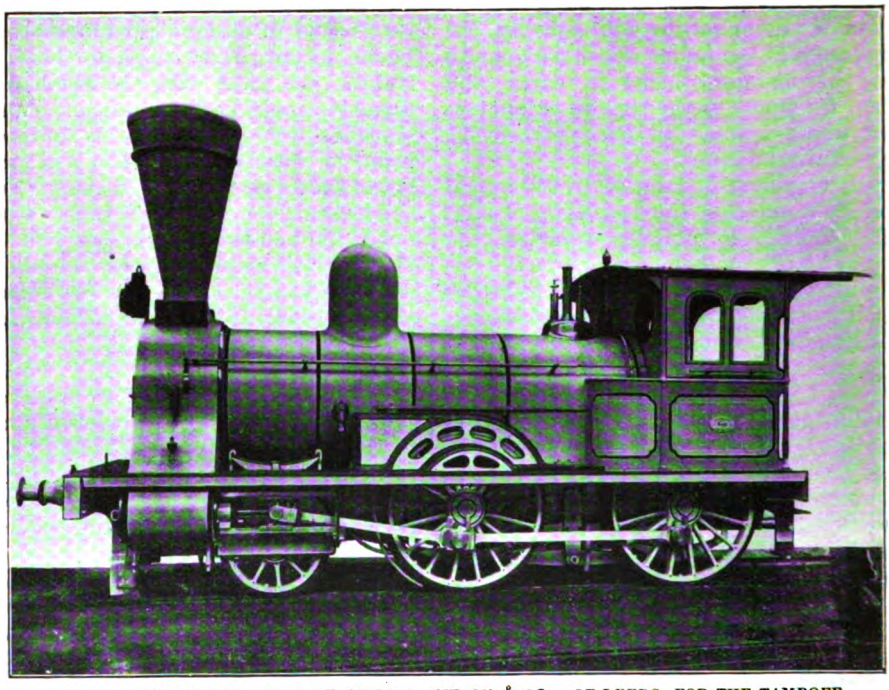
The curious old town had ever a strong charm for me, and I lived there two years. Its past history, dilapidated fortifications, rare old library, a chair of Charles XII. of Sweden, its beautiful park, and Luther's letters, all were interesting; but chiefly its people, so refined and honest, so vigorous and upright in trade. The customs of the inhabitants are very pleasing. Its festival of flowers, and its "hunger day," in commemoration of a siege, when the inhabitants suffered great hardships, are both interesting. On the latter day, at the city's expense, all the poor and hungry are fed at tables laid out on the outskirts of the town. The Feast of Fruits is another beautiful custom observed.

Having concluded my business satisfactorily, I returned to St. Petersburg, where the garrisons were changing. Regiments of Cossacks were marching in, and the sight of these wild horsemen of the Don and Volga excited enthusiasm. Perched on their small ponies, with long spears at rest—unshaven, unwashed, unkempt, singing their wild doggerel, their small Tartar-like eyes peering from beneath their bushy brows—they gave me the impression of the most unscrupulous soldiery I had ever seen, with their hiltless swords, and rope harness with wooden bits, and untidy but admirable ponies, under the most perfect control. Following them was a sight I had frequently seen—a troop of young men, sentenced for life to solitary confinement to Siberia. A sadder and more depressing spectacle it would be difficult to imagine. Fourteen healthy, strong, better-class young men, they were clad in long grey coats reaching almost to the ankles. A red cross was stitched on between the shoulders, and one long chain of iron fettered the whole number. Round their waists was an iron ring, from which depended chains fastened to the ankles. Their looks of profound misery, the clanking of their chains, the haughty words of the officer in command of the guard, impressed one with a feeling of deep pity and sympathy.



AN OLD LOCOMOTIVE BUILT BY MESSRS. KITSON & CO., OF LEEDS, FOR THE TAMBOFF AND SARATOFF RAILWAY.
At the time of their erection in St. Petersburg they were generally admired by experts from almost every firm of locomotive builders on the Continent.

[Mr. Weatherburn's next contribution will appear in the April issue of the RAILWAY MAGAZINE.]

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Great Northern Railway:

APPOINTMENT OF GENERAL MANAGER.

RARELY, perhaps never, has it happened that brothers have simultaneously held office as General Managers of two of the principal English railway systems. The distinction now belongs to Mr. Francis Henry Dent, who has filled that position on the South Eastern and Chatham system since April, 1911, and to Mr. Charles Hastings Dent, appointed towards the end of January last to succeed Mr. Oliver Bury, as General Manager of the Great Northern Company. The sons of the late Admiral Dent have established high reputations as railway administrators, and the co-operation of one has, we may mention, been sought by directors other than those whom he now serves. Mr. Francis Dent is at London Bridge, performing a particularly difficult task, but we are convinced that success will attend his exertions. By the unanimous call of Lord Allerton and his colleagues at King's Cross, Mr. Charles Dent has taken control of one of the best managed and efficient railway lines in the world, and in his case, as previously in that of his brother, we are convinced that the choice of the Great Northern Board will be advantageous alike to the Company and to the general public.

Admiral Dent was for a quarter of a century the chief officer of the Irish Channel Service provided by the London and North Western Railway. This appointment, following honourable service in the Royal Navy, laid the foundation of the enormous passenger, mail, cattle and general cargo trade now maintained between Dublin and Holyhead. Having resolved that both his sons should pursue railway careers, he sent the elder, Mr. Charles Dent, to be a premium pupil under the late Mr. F. W. Webb, Chief Mechanical Engineer of the London and North Western, while Mr. Francis Dent entered the General Manager's Department at Euston. Five years were spent by the former in the works and drawing office at Crewe, and then Mr. Charles Dent was posted to the Train Running Department. Subsequently he had charge of the Locomotive Department shops and sheds at Preston, and in December, 1892, left to become an assistant to Mr. J. Shaw, who was at that time District Superintendent in Liverpool. His next command was at Wigan, and finally he was stationed in Liverpool, first as assistant and afterwards as successor to Mr. Shaw, when that gentleman retired in 1899, as Superintendent of the Northren Division, with headquarters in Lime Street Station, Liverpool. Four years later Mr. Dent was selected as General Manager of the Great Southern and Western Railway, of Ireland and he has, therefore, directed the affairs of that company for ten years. Such an experience will be invaluable on the Great Northern system, where nothing but the best is considered good enough. There is probably no railway school in the world better calculated than the Irish to prove the all-round capacity of a General Manager, and Mr. Dent's record, therefore, stands out in bold relief as that of a singularly shrewd and successful officer.

The Great Southern and Western has a greater mileage than any other railway in Ireland. It connects Dublin with Athlone, Limerick, Cork, and Waterford, and thus covers a very extensive area in the South, West and North West. Incorporated in 1844, the company successively acquired a large number of smaller undertakings, and in 1900 made the most important absorption of all, when, after a stiff contest in the Parliamentary Committee rooms, at Westminster, it obtained power to purchase the Waterford, Limerick and Western and the Waterford and Central Ireland Railways, the mileage of which was respectively 350 and 65 miles, thereby increasing its own total to 1,121 miles. During Mr. Dent's tenure of office, great improvements have been made on the system, including the opening of the Fishguard route and the strong position held by the company is shown in the report recently issued. Mr. Dent is, we may add, a member of the Institution of Mechanical Engineers and a Lieutenant-Colonel in the Engineer and Railway Staff Corps. He served in 1911 as Chairman of the Irish Railway Manager's Conference, and will, no doubt, soon be invited to accept the same office at the Railway Clearing House conferences in this country.

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Alexandra (Newport and South Wales) Docks and Railway Co.:

APPOINTMENT OF GENERAL MANAGER.

THE Directors of the Alexandra (Newport and South Wales) Docks and Railway Company are to be congratulated upon having secured the singularly able services of Mr. J. H. Vickery as their General Manager, in succession to Mr. John Macaulay, who recently retired from that office. Mr. Vickery has gained his experience in the course of a varied career with the London and South Western Railway Company. Beginning as a junior clerk in the Goods Manager's Department, he quickly made his way, and after serving in various branches, was appointed personal clerk to the Superintendent of the Line. Before he had reached the age of 30, he became Chief Clerk in the Superintendent's Department, where he had a large staff under his immediate control. That he acquitted himself with the highest credit may be gathered from the fact that five years afterwards the late Sir Charles Scotter appointed him to the still more responsible post of London District Superintendent, and a few years later he was promoted to be Assistant Superintendent of the Line. In these positions he had charge of extensive traffic operations all over the system. Another sphere of his activity was entered upon when in May, 1899, Sir Charles Owens, then General Manager, invited him to become his Assistant. In this position, important matters connected not only with the railway, but with docks and shipping were within the range of his duties, especially as in 1892 the Company had acquired the docks at Southampton. Mr. Vickery, who has also had extensive experience in staff organisation, has been the advocate of the Company in connection with arbitration procedure, and was a member of all the various Conciliation Boards connected with the Company, of which he has in some instances acted as leading member. He has taken keen interest in the different social organisations established in connection with the Company, and has for many years acted as hon. secretary of the London and South Western Railway Servants' Orphanage. He was also Vice-President of the London and South Western Railway Servants, Temperance Union. His tact and urbanity have made him immensely popular not merely on the London and South Western system, but in railway circles generally, and no better testimony to his sterling worth as a shrewd and capable officer could be desired than the complete confidence which has been reposed in him by three General Managers successively—the late Sir Charles Scotter, Sir Charles Owens, and Mr. H. A. Walker. Mr. Vickery enters upon his new duties at Cardiff at the beginning of this month (March).

MR. J. H. VICKERY, GENERAL MANAGER.

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London, Brighton and South Coast Railway Electrification.

By AN ELECTRICAL CORRESPONDENT.

THE Board of Directors of the London, Brighton and South Coast Railway Company have, as first announced in the half yearly report, decided to proceed with the equipment of the whole of their suburban system comprised within the area extending from London to Croydon, Purley and Coulsden, and from London and Sutton to Cheam. Active steps are already taken towards the execution of the work. It was intimated that the Board had arrived at this determination after long and careful investigation of the conditions governing the suburban traffic, in view, more especially of the excellent results obtained from the limited electric service now running, and of the steady growth of the competition for this traffic by other means of transport.

As readers of the RAILWAY MAGAZINE know, the services on this system have been operated electrically for over three years. Previous to the development of electric tramways in the southern district of London, 8,000,000 passengers per annum were carried over the South London line of the Brighton Company. The result of opening the London County Council tramways was, that by 1908, this number had shrunk to something like 3,000,000, with a consequent diminution in the revenue of the railway company, and little or no compensation in the reduction of working expenses. The introduction of electric traction on this section of the line resulted in the number of passengers not only being brought back to that originally carried by steam traction before the competition of electric tramways began, but in a further increase of about 2,000,000 passengers, making a total of about 10,000,000 in all, with, of course, a corresponding increase in revenue. Little or no alterations in the fares were made when electric traction was introduced, so that the advance in receipts was really proportional to the increase in passengers carried.

On the Victoria—Crystal Palace line competition has not been felt so severely, the distances being longer, and the tramway and motor omnibus services not having been so extensively run in that area as in the districts served by the South London Brighton line. At the same time, the increase during the first 18 months of service has been most remarkable, and there is no doubt that before coming to their last important decision, the directors of the company must have satisfied themselves as regards the increase in traffic brought about by electrification. Attention is justly called by the Board to the fact that in connection with the ever-increasing competition—only just beginning in the outer circle of the Metropolitan suburban area—motor omnibuses run to Purley, giving a service which, with the present steam trains, does not exist on the railway.

No doubt the directors also had in mind the fact that by the suppression of steam working on the whole of their suburban system, considerable economies in locomotive expenses must necessarily follow, though it is hardly possible that with the limited electrification at present in operation, any such economies can be effected. It is important to note that, after four years of practical experience, the single phase system has proved such a success that it is to be continued in the extensions now to be undertaken, as also in others that may be anticipated. The sections to be next electrified comprise four tracks between Balham and Croydon and the Bricklayer's Arms (just North of New Cross) and Croydon; three tracks between London Bridge and Bricklayer's Arms; and four tracks from Croydon to Purley, the remaining sections being two car track roads.

Expressed in miles of single track the electrification carried out, including all sidings, amounts at the present moment to 70 miles. Reduced to single track, and including sidings, the section proposed to be electrified will represent nearly 150 miles, bringing up the total electrification to 220 miles, which will constitute by far the largest electrification yet undertaken by any railway company in this country. As far as the electrical equipment of the London and Brighton Company is concerned, the present rolling stock consists of 50 motor coaches, and, in round figures, another 200 motor coaches will be required to operate the extensions described. The supply of electricity from the

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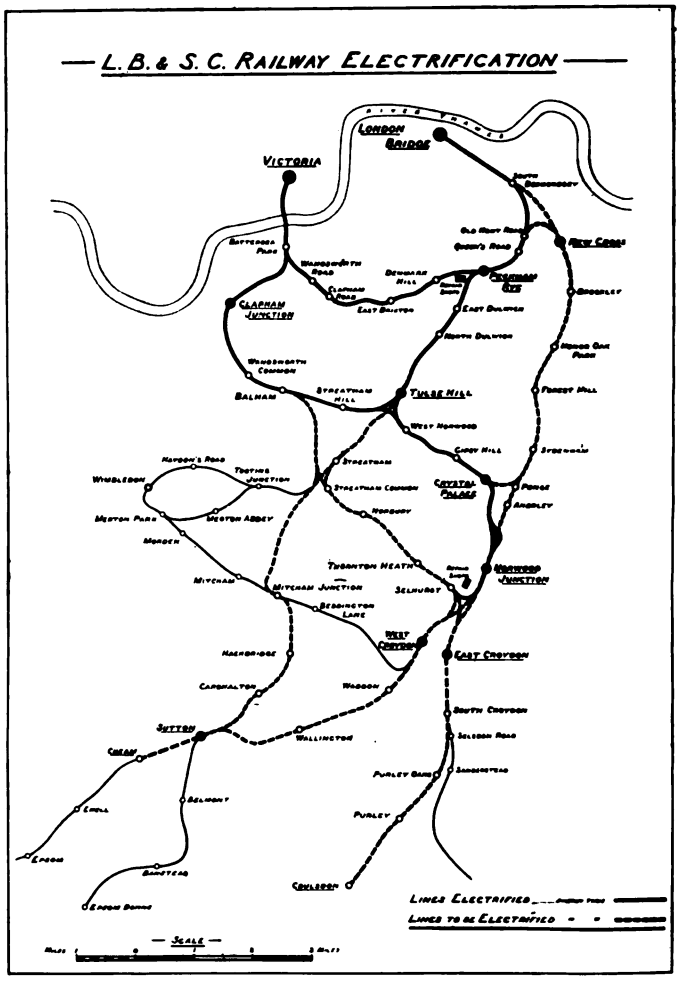
London Electric Supply Corporation has proved so satisfactory that it is intended to purchase all the electricity required for operating the suburban system from the same company. This will involve the installation of additional plant of something like 40,000,000 to 50,000,000 kilowatts, making the London Electric Supply Corporation at Deptford, including its present output, one of the largest, if not actually the largest power station in this country.



As previously stated in the RAILWAY MAGAZINE, the principal reasons which influenced the Brighton Company in adopting the single-phase system, were (1) the necessity, in their opinion, of not having a third rail, and (2) the conviction that in the near future it would be necessary to extend their electrification as far as Brighton and Eastbourne. The first of these considerations seems to appeal to every railway company, and the overhead system is apparently going to be elsewhere adopted in connection with continuous current. This is the more significant seeing that it was the overhead construction which was attacked by the opponents of the single phase system, while in respect of long-distance electrification, all authorities are virtually agreed that the single phase system possesses the greatest advantages.

The decision of the Brighton Company to extend the system of electrification, and their satisfaction with the single-phase system confirm the experience of the Prussian Government and of the New York, New Haven and Hartford Rail Road, whose directors are now completing large and important extensions on the single phase system. It is, moreover, a landmark on the road to general electrification that the determination to immediately proceed with the completion of the electrification of the whole of the Brighton suburban system should have been arrived at after three years practical experience, and the fact that this extensive scheme is expected to be carried out within four years shows that the whole of the plans and details are so well prepared that the actual work may at once be started.

It is greatly to the credit of the Brighton Company that they were the pioneers of an entirely new system of main line electrification in this country, and the Directors and Mr. William Forbes, the General Manager of the Company, are greatly to be congratulated on the energy with which they have solved one of the most difficult problems of London traffic. Congratulations are equally due to their Consulting Electrical Engineer, Mr. Phillip Dawson, on the success achieved and carried out by the installation which he designed.

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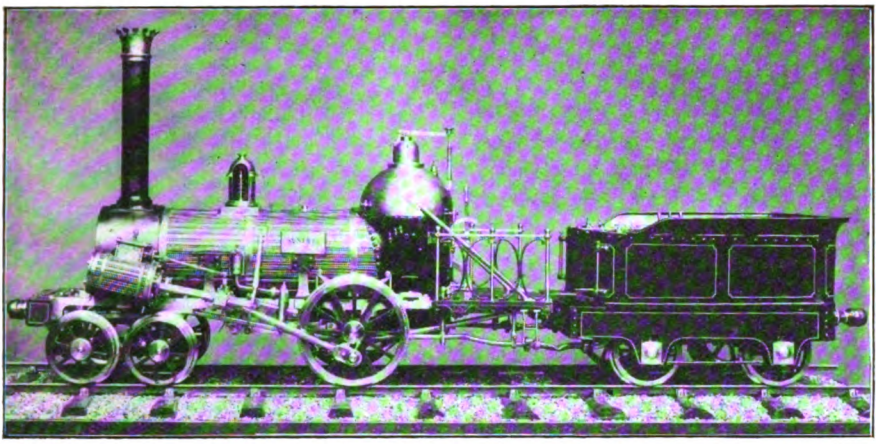

MODEL OF NORRIS LOCOMOTIVE BUILT FOR THE MIDLAND RAILWAY IN 1838.

Railway Travelling and Train Services Seventy Years Ago.

By E. A. FORWARD, A.M.I. Mech. E., A.R.C. Sc.

THE younger generation of to-day, travelling by train in luxury at high speeds and low rates, has little conception of the conditions of such travel at the beginning of the railway era. A good idea of these conditions may be obtained from a perusal of the pages of the early railway guides and time tables, and especially from the early volumes of "Bradshaw's Railway Companion," which were published from 1839 onwards, and which, with his time-tables etc., were the forerunners of the present Bradshaw's guide. These volumes are now very rare, but a few are to be found in the British Museum Library. The one now before the writer is dated 1842, and is a small volume 3 in. by 4½ in. by ⅜ in. thick, having 103 pages, and weighing about a couple of ounces. It is instructive to compare this with the modern "Bradshaw" having 1,000 pages and weighing 22 ounces.

Before looking through the "Companion," it will be advisable to say a few words as to the progress of railways between 1830, the date of the opening of the Liverpool and Manchester railway, and 1840. During this period several important lines were under construction, such as the London and Birmingham, Great Western, Grand Junction London and Southampton, and North Midland, all of which now form part of our chief lines. With regard to the passenger traffic, this developed unexpectedly on the Stockton and Darlington Railway, which was opened in 1825 as a mineral line. The carriages used were ordinary mail coach bodies, mounted on four-wheeled railway underframes, while other passengers rode in their own carriages, which were placed upon trucks, there being only one class. Passenger traffic was first specially provided for on the Liverpool and Manchester Railway in 1830, there being only one class of carriage; but in 1833, there were specially luxurious mail coaches having three compartments holding four persons in each, first class closed carriages having the same number of compartments holding six persons in each, and open second class carriages, with canopies over them, holding 24 persons in the three compartments. In 1831, however, these second class carriages had no canopies.

The trains were made up some with mail and first class carriages only, and others with second class only, the former making fewer stops at what were called first class stations, and travelling faster than the latter. Third class passengers were not thought of until about 1838, and the carriages provided for them were similiar to the open seconds without roofs. Some railways attempted to introduce open trucks without seats, for the thirds, but on most lines they were soon abandoned. These were known as "Stanhopes," or more popularly "stand-ups." The Great Western Railway started

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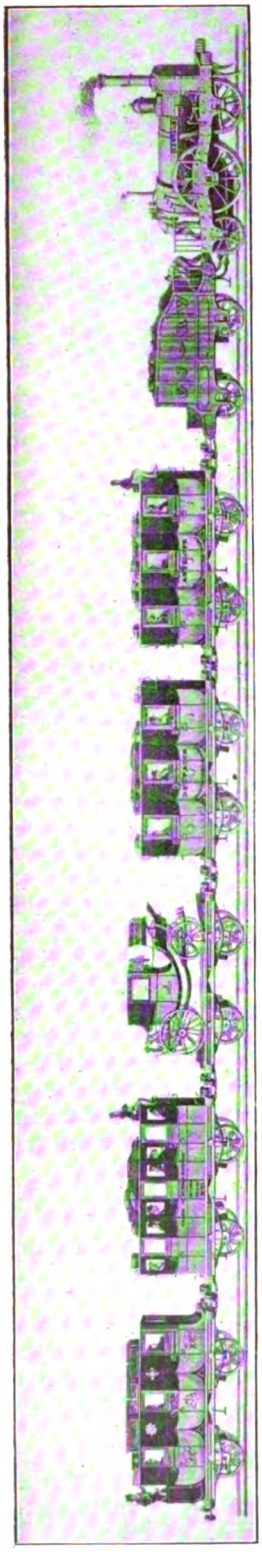

GRAND JUNCTION RAILWAY: PASSENGER TRAIN OF 1838.

with closed carriages for the second class as well as for the first-class; but these were found to detract from the number of people travelling first class, and were abandoned for the open-sided type. Mails and first class carriages were the only ones with cushioned seats. The closed carriages were made with seats at each end on the roofs, and the guards were mounted on those at the end of the train, the intermediate outside seats being available for use by the passengers. Luggage was placed on the roof of the carriage in which the owner travelled.

Turning now to our "Bradshaw," we see from the title page that it contains the times of departure, fares, etc., of the Railways of England, and also hackney coach fares from the principal railway stations. It is illustrated with maps of the country through which the railways pass and plans of the chief cities. The price was one shilling, and it was published in Manchester by Messrs. Bradshaw and Blacklock. There is then given a map of London showing the railways entering the Metropolis. These comprise the Great Western, London and Birmingham, Eastern Counties (with its terminus at Shoreditch), London and Blackwall, Greenwich, Croydon, and the South Western Railway, with its terminus at Nine Elms. The time table proper contains 32 double-page sheets, and is followed by a plan with the sections of 22 railways. There are nine maps of the railways, and plans of Birmingham, Leeds, Bristol, Manchester and Liverpool. A table is given for ascertaining the speed of a train from the time taken between two successive quarter-mile posts; the table is calculated for speeds from 1 to 400 miles an hour. A map of England and Wales shows the railways built and under construction, and a table contains the names of 42 railways with their mileage and share values. The "Companion" concludes with the cab fares in the chief cities and tables of latitude and longitude of various towns in Great Britain.

The first table deals with the London and Birmingham Railway, which was 112½ miles long, and shows that there were 13 trains leaving and 14 trains entering Euston-station during the day, and five each way on Sundays. Most of the trains were mixed, *i.e.* composed of first and second class carriages, and a few were first class only, or mails and first class. There was one third class train per day, leaving London at 7 a.m., and arriving in Birmingham at 3.30 p.m. Three trains which followed at 8 a.m., 8.45 a.m., and 9.45 a.m. all arrived much earlier. The up third class train started at 2.20 p.m., and reached London at 10 p.m.; the fastest down train was the 9.45 a.m. mail, taking 4¾ hours, while the quickest up train occupied 5 hours on the journey; and the mixed trains averaged 5½ hours. Fares from London to Birmingham were 32s. 6d. by the four inside coaches by day, or first-class six inside by night, and 30s. by the first class six-inside coaches by day. It should be noted that this company provided closed second class carriages for night travel, the fare being 25s., and open sided coaches by day, at a fare of 20s. A note states that the third class train takes passengers, private carriages, and horses at the following charges: From London to Birmingham — Passengers 14s. private carriages £3, horse boxes £4, and in proportion for intermediate stations.

Children under ten years of age were

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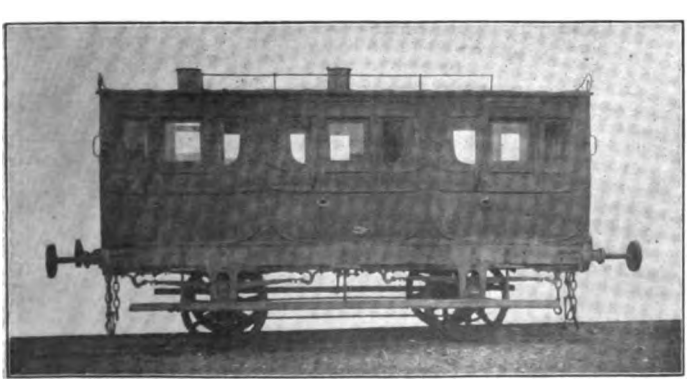
carried at half price and infants in arms, *unable to walk*, free of charge. Soldiers paid under a special agreement with the War Office. Dogs were charged for any distance not exceeding 30 miles, 1s.; 55 miles, 2s.; 85 miles, 3s.; and the whole distance 4s. No dogs were allowed to be taken into the carriages, and smoking was not permitted in the stations or carriages. It was notified that "The check ticket given to the passenger on the payment of his fare will be required from him on leaving the coach or at the station next before his arrival at London or Birmingham." Another announcement recommended passengers to have their names and addresses or destinations legibly written on each part of their luggage, and to *see* that the same were placed on the top of the coach on which they rode. Post horses, for the conveyance of carriages arriving at Euston station, could always be had at a charge of 10s. 6d., including post-boy, to go to any part of London. There were through coaches running from London to Liverpool and Manchester, and passenger tickets were available by any train on the day of issue.

The second table deals with the Great Western Railway, which was then working as far as Bridgewater—a distance of 151¼ miles. There were fourteen trains leaving and entering Paddington daily, six of which travelled the whole distance. Two goods trains also appear in the timetable. On Sundays there were three end-to-end trains and other intermediate ones. The down mails performed the journey in 5½ hours, and the other trains in about 6 hours. Fares from Paddington to Bridgewater were: First class, 38s.; second class, 26s.; third class, 16s.; carriages, four-wheeled, 72s., two-wheeled 60s.; horses 65s. pair 85s. Passengers were allowed ten minutes stoppage at Swindon for refreshments. There is no indication as to the class of carriage of which each train was composed.

Table III. shows that the London and South Western Railway was working from Nine Elms to Southampton and Gosport. There were seven trains each way between London and Southampton, 77 miles, and four to and from Woking. These were first class only and first and second class. There were also two goods trains, to which third class carriages were attached. On Sundays three trains run to Woking, and three to Gosport. Fares from London to Southampton were: First fast, 21s.; mixed first class, 20s.; second, 14s.; third 8s. The fastest trains did the 77 mile journey in 3 hours, but the third class goods trains left London at noon and 10 p.m., and arrived in Southampton at 6.10 p.m. and 4 a.m., respectively. First class trains conveyed only first class passengers, except that accommodation was afforded for a limited number of servants in livery. Passengers by mixed trains riding in their own carriages were charged second class fare. The Northern and Eastern Railway between London and Cambridge was completed only as far as Bishop's Stortford, the London terminus being in Shoreditch. Eight trains ran each way daily, most of them as far as Broxbourne only, and six on Sundays. There were three classes of carriage, but the third class were run with only three of the trains on weekdays, and with all but one on Sundays. The fares were 7s. 6d., 5s. 6d., and 3s. 6d., for the 30¼ miles.

One of the most interesting of these early lines was the London and Blackwall Railway. It was 3¾ miles long, and had two tracks, upon which the trains were hauled backwards and forwards by two ropes wound upon drums driven by steam engines at each end of the line. Each line was thus alternately the up and the down line, and each intermediate station had special carriages assigned to it, these being detached from the cable when they arrived at their proper stations; and they remained there until the cable was reversed so as to return them to the starting point. The electric telegraph was used for signalling to the termini. Trains ran every 15 minutes, the



GREAT WESTERN RAILWAY: AN OLD FIRST-CLASS CARRIAGE.

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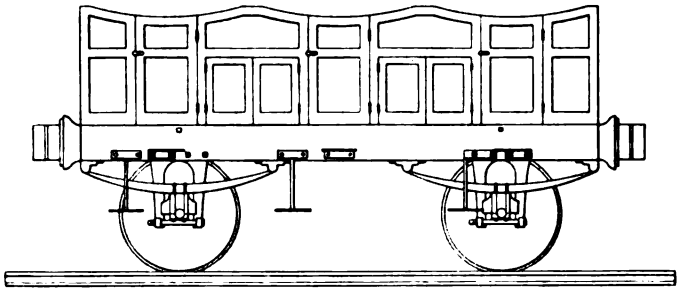


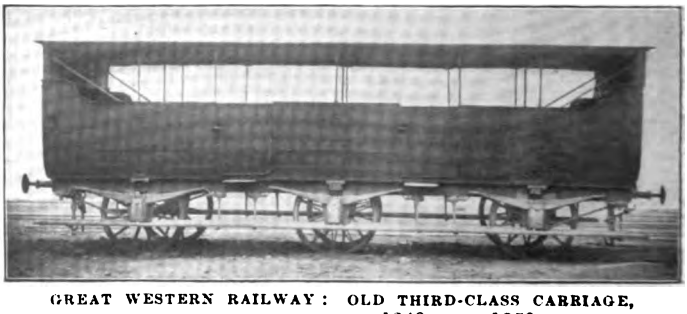
THIRD-CLASS OPEN-SEATED CARRIAGE, 1840.

running time being 13 mins. Fares were: First class 6d., second class 4d., and the second class carriages were of the "standup" type. The London and Greenwich line, noted for its thousand arches, ran a 15 min. service from 8 a.m., to 10 p.m., there being first class closed carriages, fare 9d., and second class seatless trucks, fare 6d.

The London and Brighton Railway, 50½ miles long, ran seven trains daily, one being a goods train, to which third-class carriages were attached. There were also two trains to Croydon. Four of the trains were mixed first and second class, and two first class only. On Sundays there were three trains. The quickest train consisted of first class carriages only, and it completed the journey in two hours, whereas the goods train occupied 3½ hours. Mixed trains stopped at all stations, while the first class ones stopped at the first class stations only, these being Croydon, Redhill, Three Bridges and Haywards Heath. Fares for the whole single journey were 14s. 6d. first, 9s. 6d. second, and 6s. third. Cheap day tickets to Brighton were issued at return fares of 20s. first and 15s. second. The branch to Shoreham was also working.

At the same time the South Eastern Railway was open from London Bridge to Tonbridge, *via* Croydon and Reigate, a distance of 40 miles. Coaches met the trains at Tonbridge to convey passengers farther south. There were only four trains daily, taking two hours, and stopping at all stations. Fares were 10s. first class, and 6s. 6d. second class. Through bookings were available by rail and coach to Hastings and neighbouring places. First class passengers were allowed 84 lbs. of luggage and second class 56 lbs. Dogs were charged 2s. 6d. for any distance, but were not admitted to the carriages. The Eastern Counties line was open from Shoreditch to Brentwood only, there being eight trains each way daily. Fares were 3s. 6d., 2s. 6d., and 2s. for the first, second, and third classes respectively. On the London and Croydon railway there were 12 trains daily over their ten miles of line, and eleven on Sundays. The fares for the whole distance were 2s. 3d. first class, and 1s. 9d., second class. Third class passengers were conveyed between New Cross and Croydon only. The Taff Vale railway was running three trains on weekdays and two on Sundays, the fares being 5s. first, 4s. second, and 3s. third. Out of its 45 miles of line the Manchester and Birmingham Railway had only the short sections completed between Manchester and Stockport and Sandbach. The Sheffield and Rotherham line, six miles long, and an important connecting link, was also working. The pioneer line, the Stockton and Darlington Railway, ran six trains between Stockton and Darlington on weekdays, but none on Sundays, it being noted that horse coaches ran with the mail twice on those days.

One of the most important was the Grand Junction Railway connecting the London and Birmingham line with that from Liverpool to Manchester. The former had running powers over the latter, and its trains took precedence when joining the line at Newton Junction. There were six trains daily each way and one between Birmingham and Stafford, some having through carriages to and from London. There were mail trains,



GREAT WESTERN RAILWAY: OLD THIRD-CLASS CARRIAGE, IN USE BETWEEN 1840 AND 1850.

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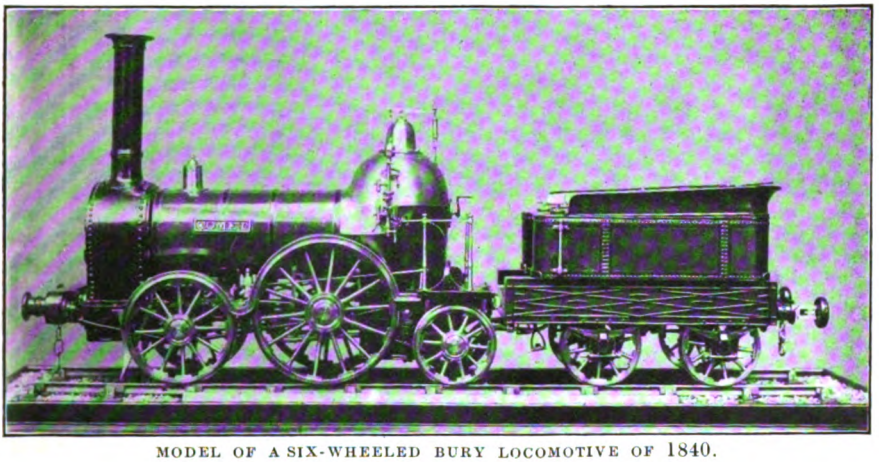
mixed and second-class, third-class passengers being carried by one train only. Fares from Birmingham to Liverpool or Manchester were, by mail trains 25s.; by ordinary first-class 23s.; by second-class 18s.; and third-class 11s. On Sundays there were three first-class trains and one mixed, stopping only at first class stations. Passengers were required to be at the first class stations 5 min. and at the second class stations 10 min., before the train time. The fastest down trains took four hours and the up trains 4½ hours. London could be reached from Liverpool in 9¾ or 10 hours.

Upon the 18 miles of railway between Crewe and Chester the trains ran in connection with the Grand Junction trains, the fares being 6s. 6d. 5s., and 4s. The Birmingham and Derby Junction Railway, 41¼ miles long, ran five trains on weekdays and three on Sundays. There were through carriages from London to Nottingham, Sheffield, Leeds, York, Hull and Darlington, a branch from Whitacre Junction to Hampton on the London and Birmingham Railway facilitating the through traffic from London. By some trains passengers had to re-book at Hampton. All the trains from Derby to Birmingham took 2 hours or 1 hour 50 min. The Birmingham and Gloucester Railway, 51 miles in length, ran seven trains per day each way, two being mails and one a goods train for the accommodation of third-class passengers. On Sundays, only the mail trains ran, and there were through bookings by certain trains to and from London. Between Birmingham and Gloucester the fares were :— First-class 13s. 6d.; second-class 9s.; and third-class 5s. 6d. The mail trains performed the journey in 2½ hours, while the goods train took 4 hours. The Liverpool and Manchester Railway ran first-class trains consisting of mail carriages, holding four persons in a compartment, at a fare of 6s. 6d. and first-class glass coaches, holding six persons in each compartment, at a fare of 6s. Second-class trains had some of the glass coaches, fare 6s., and second-class open sided carriages at 4s. 6d. Other trains had second-class carriages only. There were four first-class trains per day, two mixed and five second-class; on Sundays three first, one mixed, and two second class. Times of departure only are given, and no arrivals. Tables are also printed for the connecting lines to Preston, Fleetwood, Lancaster, Bolton and St. Helens, all of which had two classes only.

The Manchester and Leeds Railway was 60 miles long, and the table shows 10 trains on weekdays and four on Sundays. The fares are given as 3d. per mile first-class, and 2d. per mile second-class. Passengers could be booked through from Manchester to London and elsewhere, but only one train, leaving Manchester at 7 a.m. carried passengers to London in "waggons," this being one of the lines on which the open, seatless trucks were used. No third-class fares are given except as regards through traffic with other lines, but it is stated that servants riding outside and children were charged waggon fare. Waggon passengers could travel by three trains on weekdays and by all Sunday trains. Connections at Normanton with other lines are shown, and also an arrangement for travelling to London *viâ* Hull by rail and steamer. The time of the trains averaged about 3 hours, a few taking 3½ hours. The Midland Counties line ran



MODEL OF A SIX-WHEELED BURY LOCOMOTIVE OF 1840.

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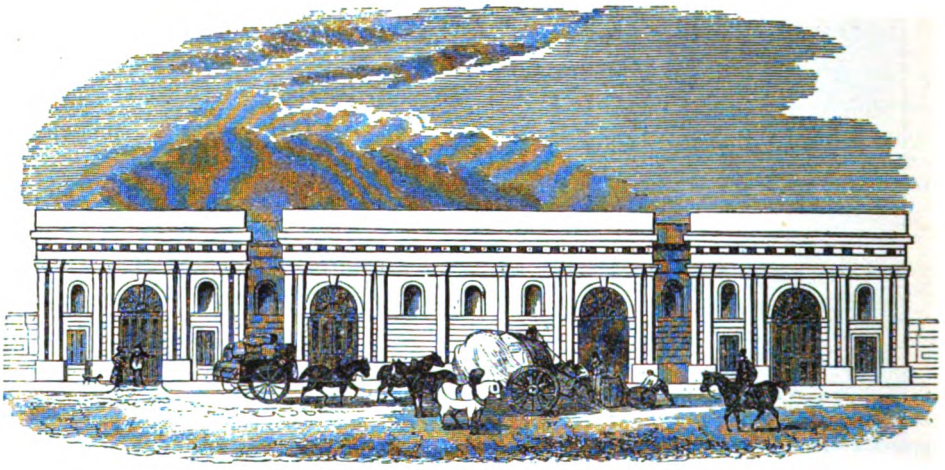
from Rugby to Derby, with a branch to Nottingham, and had a length of 57 miles. There were six trains between Rugby and Derby, five between Derby and Nottingham on weekdays, and four and three respectively on Sundays. Some trains were first and second class only; others had three classes. The London and Manchester connections appear, the time taken being about 12 hours.

North Midland Railway ran from Derby to Leeds, 72¾ miles, and passengers travelled thence to York, Hull and Darlington by the York and North Midland Railway, the Leeds and Selby Railway, the Hull and Selby Railway and the Great North of England Railway. There were six trains on weekdays between Derby and Leeds and three on Sundays, one being a mail train. The fares were 18s. first, 12s. second and 9s. third. Third-class passengers were conveyed from London by one train only, leaving at 7 a.m. and arriving in Leeds at 9.45 p.m. the fare being 24s. First and second class carriages were attached to all the trains, and three had third-class carriages. Mail trains took about three hours, and the slow ones about 4¼ hours. Passengers were particularly requested to notice the number of the carriage on which their luggage was placed. On the Newcastle and Carlisle Railway, 60 miles long, there were five trains on weekdays and three on Sundays, one being a mail. The mails performed the journey in three hours, and the other trains in 3½ hours. The fares for the whole distance were 11s. first and 8s. 6d. second. York and North Midland line ran from York to Normanton, 23 miles, where it connected with the North Midland and the Manchester and Leeds lines. There were also connections with the Leeds and Selby Railway. The timetable gives the trains from York to Leeds, Hull and Selby, Normanton and London, there being four or five trains a day to each. Fares from York to London were first-class, £2 16s. and second-class £1 18s.; to Manchester they were £1. and 13s. Times of arrival are not given, and no intermediate stations are noted.

The Great North of England Railway between York and Darlington was 45 miles in length. Passengers travelling from Newcastle to London had to take the coach to Darlington, train by the Great North of England line to York, thence by the York and North Midland to Normanton, on by the North Midland to Derby, by the Midland Counties Railway to Rugby, and by the London and Birmingham line to London, the journey occupying 18¼ hours. Fares from Darlington to London were £3 8s. first, and £2. 6s. second. There were five trains daily between York and Darlington and one on Sundays, third-class carriages being on three of the number. Fares were 12s., 8s., and 5s. The quickest train completed the journey in two hours, and the slowest in 2½ hours. This piece of line is the portion of the North Eastern Railway over which the fastest booked run is now made, one train taking only 43 min. The Hull and Selby line was 30¾ miles long. On weekdays there ran upon it 6 trains each way, and on Sundays two up and three down. Fares



THE ORIGINAL STATION AT BIRMINGHAM: GRAND JUNCTION RAILWAY.

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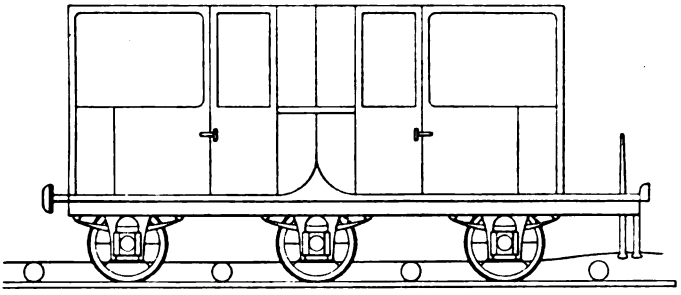
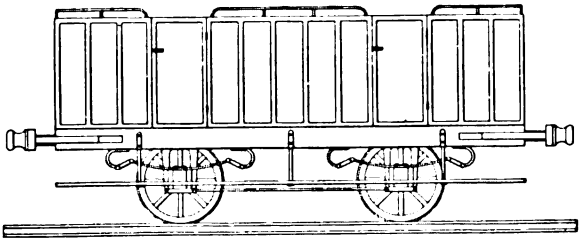


COMPOSITE FIRST AND SECOND-CLASS CARRIAGE USED ON THE LONDON AND BLACKWALL RAILWAY IN 1840.

were 5s., 3s 6d., and 2s. 6d., first, second and third respectively, the quickest time being 1½ hours. There were cheap trains from Hull to Sheffield (time 5 hours), and others to York in 2¾ hours. A note states that refreshments may be had in the house adjoining the passengers' booking office at the Hull Station. The line from Manchester to Sheffield was working to Godley only, and there were 10 trains per day, each taking 32 min. All these had first, second and third-class coaches, the fares being 2s., 1s. 3d., and 1s. The journey to Sheffield was completed by coach. Tables for the Stockton and Hartlepool, and the Durham and Sunderland railways occupy only a small space.

The Manchester and Bolton Railway, 10 miles long, ran three first-class trains stopping at one intermediate station only, and four second-class trains stopping at all stations. On Sundays there were two trains stopping everywhere. Fares were 2s. 6d. first-class, and 1s. 6d. second-class, but on Sundays the latter was reduced to 1s. Connections and fares are given with the Bolton and Preston Railway, which was open only as far as Chorley, the journey being completed by coach. Third-class passengers were conveyed by all trains between Bolton and Chorley at fares of 2s. 6d., 1s. 6d., and 1s. On Sundays second-class passengers were charged third-class fares. The North Union Railway, now a link in the West Coast Route, ran between Preston and Parkside, on the Liverpool and Manchester Railway, a distance of 22 miles. Trains were first-class, second-class, and mixed. Through carriages ran to Birmingham and London on two of the first-class trains, the fares being 55s. 6d. by day and 58s. by night. The Lancaster and Preston line, 20 miles long, continued the railway north to Lancaster. It had five trains daily, two being mails, one first-class, and two mixed. There were third-class carriages on all the mixed trains, which stopped at every station. Two trains had through carriages to Birmingham and London. Fares from Preston to Lancaster were 5s., 3s., and 1s. 6d. Other short lines given are the Bolton and Leigh, 10 miles; Leigh and Kenyon; Chester and Birkenhead, 15 miles; Preston and Wyre, 19 miles; and Newcastle and North Shields 6¾ miles.

In Scotland the chief line was the Edinburgh and Glasgow, 47¼ miles long. It had 6 trains per day from each end and two on Sundays. All the trains except one carried three classes of passengers, and first-class elegant *coupé* carriages were included in two trains. Fares were 8s. first-class, *coupé* 10s.; 6s. second, 4s. third; children between 10 and 14, half fares, under 10 free, if with a person paying full fare. There were also goods trains at 6 a.m. having third-class carriages attached, and performing the journey in 3½ hours at a cheap fare of 2s. 6d. The quickest train took 2 hours and the others 2¼ or 2½ hours. The Garnkirk and Glasgow Railway, 8¼ miles long, provided four trains daily; Glasgow, Paisley and Greenock 8 trains on weekdays and none on Sundays; and the Glasgow, Paisley, Kilmarnock and Ayr Railway 5 trains a day at fares of 6s., 4s., and 3s. for the whole distance. There were three classes of carriage between Glasgow and Johnstone and only two between Johnstone and Ayr. Two trains, however, had third-class all the way. The line between Arbroath and Forfar had five trains daily, the fares being 2s. 3d., 1s. 9d., and 1s. 3d. Dundee and Arbroath line, 16½ miles long, ran in summer 6 trains a day at fares of 2s. 6d., 2s., and 1s. 6d. first,



THIRD-CLASS "WAGON," WITHOUT SEATS: MANCHESTER AND LEEDS RAILWAY, 1839.

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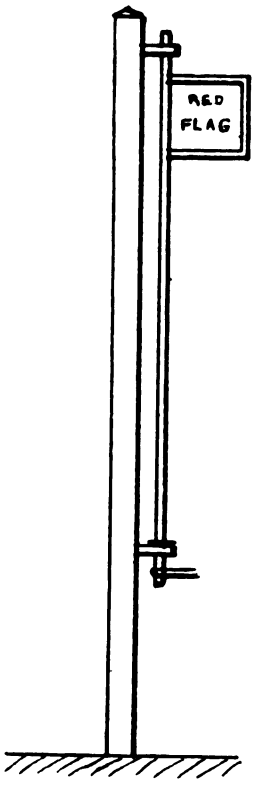
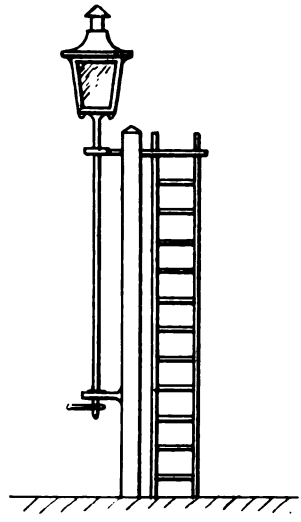


DAY SIGNAL : LIVERPOOL AND MANCHESTER RAILWAY, 1840.

second and third class. There was also a mail train, first and second only, with fares of 3s. and 2s. 6d. Paisley and Renfrew Railway, 3 miles long ran hourly trains, first and second class, fares 6d. and 4d.

Ireland is not mentioned. The time-tables conclude with one giving the times of the "Swift packet boats on the Lancaster canal, travelling upwards of 9 miles an hour," by means of which travellers could reach points north of Lancaster. Fares were 3s. first-class and 2s. second-class. A note states that the packets were warmed in winter.



NIGHT SIGNAL : LIVERPOOL AND MANCHESTER RAILWAY, 1840.

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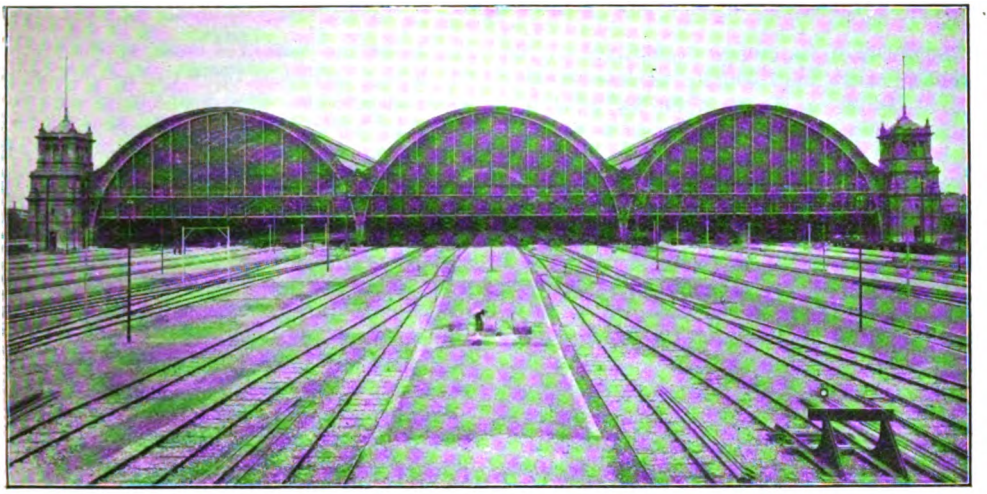

CENTRAL STATION, FRANKFORT.

Railways in Rhineland.

By J. T. LAWRENCE, M.A.

UNDER the above heading, the lines proposed to be considered are those from Dusseldorf to Mayence and Frankfort, which between Cologne and Mayence, run for the most part along either bank of the river. The total distance on the left bank is 163 miles, and by the right bank another couple of miles. Considerably more than 100 miles on each side are laid within a few yards of the river. Alongside the rails are well-made roads, much frequented by motor-cars. And as a thoroughfare, the river itself must not be forgotten. The amount of traffic, both passenger and. freight, up and down stream is immense. As might be expected, the former is mostly of the tourist description, and the summer services are on a generous scale. And as to freight, the importance of the Rhine in this respect is due to the fact that it traverses the great Westphalian coal fields, and there seems to be a never-ending procession of barges, laden to within a few inches of the water's edge, bearing coal thence to the south of Germany. Coal also seems to be the staple of the freight traffic along the adjacent rails, and trains of from 50 to 70 wagons almost "tread on each others' heels."

There are some things in which English raliway management excels that of the Fatherland, and others in which the superiority undoubtedly remains with the Teuton. From the point of view of public convenience, the advantage would seem to rest with the latter, and it might be added that no other point of view is open to the railway writer—a fact which brings one to a comparison which is in our own favour. In England it is possible to acquire all the information about a railway and its management for which any one can reasonably ask. Officials are courteous and communicative. In Germany they are only courteous. Here the interest of the public in details is encouraged. Members of the public are invited to make suggestions, and an important section of the press ministers to and maintains that interest, all with the approbation of directors and general managers.

But in Germany there is no such public interest, and if there were it would be sternly discouraged. The railway is one department of the public service. No official outside the highest grades has any information, nor even any concern about anything that goes on beyond his own particular area or his immediate sphere of duty ; and any curiosity on the part of the public might be regarded as an attempt to undermine the integrity of a public servant ! The traveller's interest in the railway is supposed to begin and end with the fact of his own conveyance and the transport of his baggage from one point to another. Certainly the Railway Administration carries out its share of the transaction with great thoroughness. The traveller may

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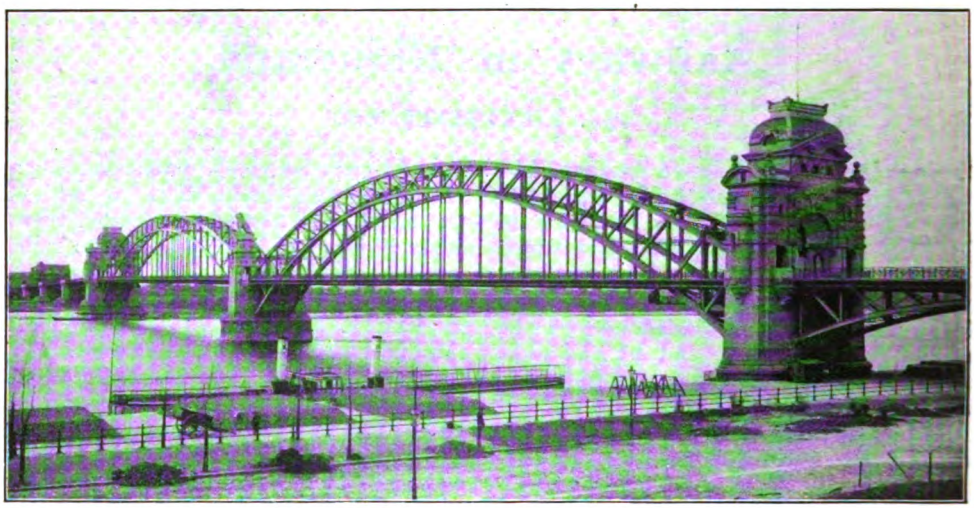
chafe at the apparently meaningless restrictions that hem him in on every side, and if he be an Englishman he probably does so; but the main fact remains that he loses neither himself nor any part of his belongings, and arrives at his destination with commendable punctuality. Access to station platforms is severely restricted to holders of tickets of one kind or other, and waiting room accommodation at the principal stations is usually of a high order. Trains are almost entirely made up of corridor stock, and there are very few which now exclude the third-class passenger. Such are the "internationals" run in connection with the steamers, as, for instance, the "Luxus-Zug" from Ostend to Vienna. All tickets, whether in slow trains or fast, on main line or branches, are inspected *en route*, and only a most perverse traveller could possibly get into a wrong compartment.

At Dusseldorf all admire the "Haupt-bahnhof," or principal station, which occupies one side of an open space near the centre of the town. The bridge over the Rhine, by which we have arrived at Dusseldorf, is worthy of more than a passing look. It was built by the Gutehoffnungshutte, of Oberhausen, and completed in 1908. The two main spans are on the suspension principle, and the central pier is surmounted by a sculptured lion, the heraldic badge of the town. To Cologne the distance is 24¾ miles. There are 37 trains daily, and 33 in the reverse direction. The express time is 34 min. Cologne station is entered by crossing the Rhine from the right to the left bank, the bridge, which is a double one, carrying both the railway and the tramways. It is a massive and noble structure, and finely sculptured lions guard the approach.

Cologne station, located in the "Dom-Platz," stands in front of the majestic cathedral, a fact which in the design naturally compelled some attention to æsthetic considerations. Very few handsomer stations are anywhere to be found. The frontage is of great length, and there are two entrances, the chief of which in a remarkable degree combines dignity and beauty. The whole of the ground floor is given over to station administration, and in addition to a very large circulating area, comprises all the departments which deal with baggage, booking offices, and the offices of the station staff. Access to the platforms, which are on the first floor, is gained by two sets of spacious staircases. The platforms are of immense length. They measure about 1,600 ft., of which only about 500 ft. are uncovered. The greatest width is 150 ft., and the centre of the station is occupied by a hall, 100 ft. by 140 ft., which serves as a waiting room and also accommodates the refreshment department, bookstalls, etc. There are four running roads within the station, and two outside. The latter are supported on brackets, and thus form a balcony or roof which completely covers the street pavement below. In addition to these six through roads, there are eight lines which



RHINE BRIDGE, DUSSELDORF.

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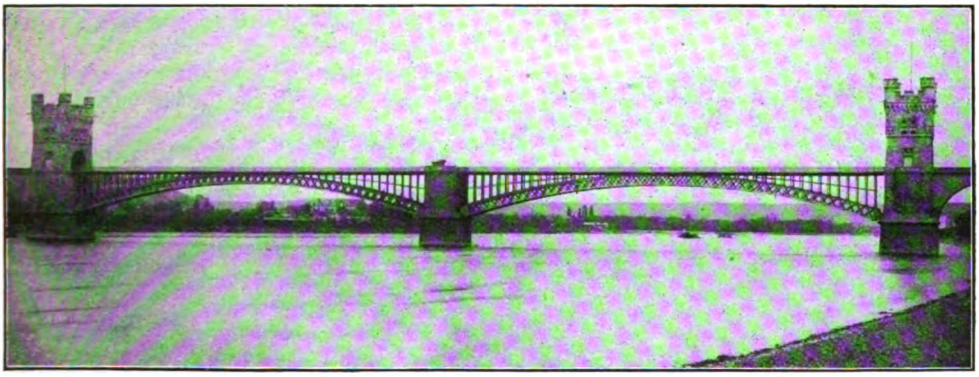
find their termini in the station and run into bays. In all there are 14 platforms.

From the ground floor to the platforms there are 12 lifts, four being used for post office purposes. There are 24 booking offices, and the highest day's takings are £1,700. The station cost £1,600,000 to build, and no pains were spared to make it worthy of its majestic neighbour. But with a view to avoid comparison, the façade was kept low, and consequently the height of the clock tower is only 140 ft. By night as well as by day the station is always busy, there being during the twenty-four hours 260 departures and 248 arrivals. There are nine different directions of travel from Cologne, and as far as international trains are concerned, those from Paris to Berlin and from Ostend to Vienna are the chief.

Beginning our journey along the left bank, and leaving the Central station just described, we pass two subsidiary stations—Cologne West and South—and a run of 20¾ miles brings us to Bonn, the great educational centre of this part of the country. The trains do not attain any very high speed, even the Vienna express, first class only, which leaves Cologne at 11.58 p.m., taking 32 min. The steel bridge across the Rhine, built, as are most of the Rhine bridges, by the Oberhausen firm mentioned, is in three spans, of which the centre one is suspended from two arches. Here it may be said that Rhine tourists usually take train as far as Bonn, and thence travel by steamer, inasmuch as the scenery below Bonn is not regarded as of great interest; but the station is nearly a mile from the landing place.

The express trains next run from Bonn to Coblenz. Shortly after leaving Bonn, the seven mountains—and in particular the precipitous crag on which are still to be seen the ruins of a castle known as the "Drachenfels"—are plainly visible at the left hand, on the opposite side of the river. In this neighbourhood the chief industry seems to be the manufacture of cement; and chimneys are strangely mixed up with ruined castles. At Neuwied, also to the left, are Krupp's famous blast furnaces. Before reaching Coblenz, the rail leaves the river to avoid a bend, and runs into the town by way of a bridge over the Moselle, at the confluence of which with the Rhine the town is situated. In fact, the name is derived from "confluence." Passengers by rail miss seeing the magnificent national monument, an equestrian statue of the Emperor William, which, at the meeting of the waters, at once attracts the passenger by steamer.



RHINE BRIDGE, COBLENZ.

From Bonn to Coblenz the distance is 36¾ miles, the journey by the best trains occupying 53 min. There are two fine bridges spanning the river, one of which is here illustrated. For public use there is, in addition, a bridge of boats and a steam ferry. On the left, just visible from the train as it crosses the Moselle, is the fortress of Ehrenbreitstein, built on a rock nearly 500 ft. high. From Coblenz to Bingen the scenery is very romantic. The railway follows the windings of the river, and castles, ancient and modern, are encountered on either bank every few miles. The river is hemmed in by hills from 300 ft. to 400 ft. high, and at the foot of the hills nestle such beauty spots as Kapella, Braubach, St. Goar, Oberwesel, Boppard, and many others. For 30 miles or more there is a constant succession of vineyards. Nearly opposite to St. Goar, is the celebrated Lorely rock, rising

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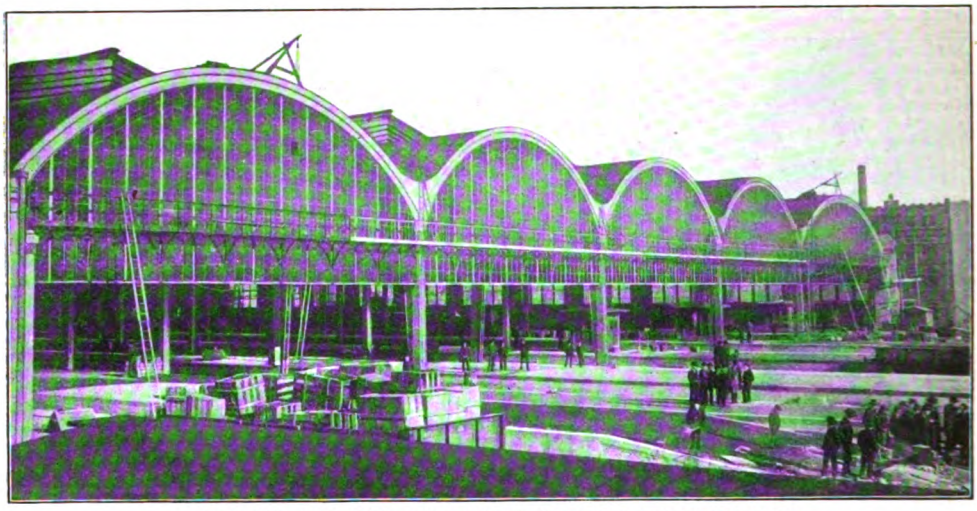
sheer out of the water for about 450 ft. The robber barons of old, who perched their castles on almost inaccessible peaks, seem to have been also alive to the strategic possibilities of the small islands which occur in mid stream, and every islet has its ruined tower, from which in the "good old days" the "bold, bad barons" used to levy a reluctantly paid toll on passing boats.

A run of 38½ miles brings the traveller to Bingerbruck, on the north side of the Nahe. The expresses do not in every case stop there, but cross the Nahe by an iron bridge, and run into Bingen, 39½ miles from Coblenz. Bingerbruck, a junction, is a locomotive depôt, and the run of 38 miles from Coblenz takes 54 min. Across the river is the better known Bingen, and from this point the country is more or less flat. Nevertheless, the easy run of 18½ miles thence to Mayence takes 26 min. At Bingen there is a railway ferry to Rudeshein, almost opposite, whence the line on the right bank goes direct to Wiesbaden. Wiesbaden is the "Harrogate" of Germany, and, although the waters are not quite so nasty as those of the English Spa, the crowd of "invalids" is quite as great. Wiesbaden station, a very striking edifice, opened in 1905-6, is a terminus, and the possibility of a train entering the station not entirely under control is provided for by covering the metals with ballast for some little distance in front of the hydraulic buffers.

Frankfort is the terminus of most of the trains, but, after leaving Mayence, the rail leaves the river altogether. The railway station at Mayence was illustrated in the RAILWAY MAGAZINE, Vol. XVII. p. 493. Its façade is sculptured with classical subjects, and over the clock is a magnificent figure of Mercury holding aloft a torch, and with wings outstretched—a very appropriate emblem for a railway whose trains are expected to keep time. The station was opened in 1884, its erection occupying over three years, and it fills a space of more than 100 acres. Altogether it cost nearly £1,000,000. Between 6 a.m. and midnight 300 trains arrive and depart, and the total staff exceeds 1,100.

Stations on the continent are built with far more attention to æsthetic considerations than in this country; and when we compare, say, Fenchurch Street or the Leeds Midland station with palaces such as the stations in Cologne, Frankfort, and Antwerp, one positively blushes. Frankfort station is one of the biggest in the world, and its exterior was illustrated in the RAILWAY MAGAZINE, Vol. XVI., p. 380. I am able to give two other illustrations, kindly furnished by the Gutehoffnungshutte, who erected the structure. It occupied five years in building—from 1883 to 1888—and cost about 35,000,000 marks, roughly, £1,700,000. Nearly 500 trains use the station, carrying about 30,000 travellers every day. The staff exceeds 1,000. The main vestibule is 450 sq. yds. in area, while the station hall, spanned by three immense bays, is 550 ft. wide and 610 ft. in length.



NEW STATION AT WIESBADEN IN COURSE OF CONSTRUCTION.

We have now completed our trip along the left bank, and, going back to Cologne,

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RHINE BRIDGE, BONN.

may travel along the parallel line of rails on the other bank, starting from Rudesheim. Connection between the two lines is made both at Bonn and at Coblenz, and there are trains which proceed to the latter station along the one bank, and, crossing over the river, resume along the other. Of this line, the termini are Cologne (or Deutz, just across the river) and Wiesbaden. The distance is 115 miles, but the average express time is three hours, only one train taking less.

If the traveller cannot go by steamer, the right bank provides him with most scenic attractions, as the finest ruins are on the opposite bank. A mile or two from Rudesheim is Assmanshaussen, where a motor ferry runs to the splendid Castle of Rheinstein. About 13 miles further on the train runs through the Lorely rock, which is tunnelled, and the song of the siren is replaced by the whistle of the locomotive. The train, adhering with great faithfulness to the river bank, winds its way around the foot of the great fortress of Ehrenbreitstein, and a a fine view is afforded of the monument already mentioned. Konigswinter is the chief tourist resort in this neighbourhood, the Drachenfels being the attraction, and the 1,065 ft. ascent may be made, if desired, by the climbing railway. Cologne is eventually reached by way of the very handsome bridge to which allusion has already been made.

NEW DINING SALOON FOR HARROGATE SERVICE: GREAT NORTHERN RAILWAY.

This saloon is provided with oval tables, movable armchairs, and is otherwise specially fitted, as described in the RAILWAY MAGAZINE, January, 1913.

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A Remarkable Locomotive Family:

THE 2-4-2 TANK ENGINES OF THE LANCASHIRE AND YORKSHIRE RAILWAY.

By HAROLD SEVILLE.

I FEEL that no apology is needed for this article. As a constant and eager reader of the RAILWAY MAGAZINE, I have observed that the humble Tank Engine has hitherto received somewhat scant notice. This is perhaps natural, and it may be said that the doings of his more exalted brethren of the road—the express engines—provide ample material for record in a monthly Magazine, not to mention descriptions of new engines and lines constantly coming into use and those of interest already opened.

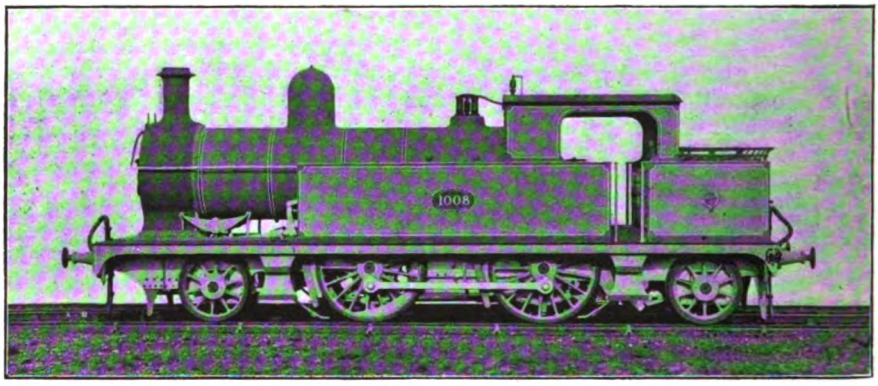

FIG. 1.

Still, after all, the Tank Engine is the handyman of the Railway World, and as such commands more than casual attention. I have chosen the 2-4-2 Tank Engines of the Lancashire and Yorkshire Railway as my subject for three reasons: Firstly, because I have long been their admirer; Secondly, because they comprise the biggest class of passenger Tank Engines on any British line, and so probably in the world; Thirdly, because the Lancashire and Yorkshire Railway makes use of Tank Engines to an extent unheard of on most British Trunk Lines.

The first engine turned out from the new Horwich Shops of the Company in February 1889 was designed by Mr. John A. F. Aspinall, and was also the first of this numerous class, No. 1008 (works No. 1), Fig. 1, and since then few years have passed without witnessing the advent of one or more batches of the same type. Their appearance in annual order is here given: In 1889, 10; in 1890, 20; in 1892, 40; in 1893, 20; in 1895, 20; in 1896, 40; in 1897, 20; in 1898, 60; in 1899, 20; in 1900, 12; in 1901, 8; in 1905, 20; in 1910, 20; in 1911, 20—making 330 engines of virtually one type. I say "virtually" because these engines, in spite of a general similarity, both in outline and detail, have kept well abreast of the times. For instance, in October, 1898, appeared No. 5 (works No. 611), Fig. 2—the first of the class with increased coal and water capacity. This was effected by lengthening the frames at the trailing end and also the bunker, whereby the capacity was increased from 1,340 gallons of water and 2 tons of coal

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to 1,540 gallons of water and 3 tons 3 cwt. of coal. All subsequent engines have been built to this modified design. Again, later still, the pressure has been increased from 160 lbs. per sq. in. to 180 lbs. per sq. in. Belpaire fireboxes and extended smokeboxes made their appearance in the 1905 batch, Fig. 3, and these features have been perpetuated. Further, all engines requiring new boilers are fitted with this new standard boiler, so that eventually the whole class will in this respect be uniform.

But the most remarkable development took place in the last batch, Fig. 4. Hitherto the engines had cylinders 18 in. by 26 in.—some batches 17½ in. by 26 in.—but Mr. Hughes, being convinced that superheating had come to stay (and pay), introduced the Schmidt system in these latest engines, with the result that we see the cylinders increased to no less than 20½ in. by 26 in. The loading of the axles, too, sheds some light in the gradual change of opinion on the question of the maximum allowable load per axle. Twenty-five years ago 18 tons was considered excessive in a single driver, although this weight was exceeded by Mr. Patrick Stirling in his big Great Northern 8-" footers," and by Mr. Charles Sacre in his 7 ft. 6 in. singles on the Manchester, Sheffield and Lincolnshire Railway. As for four-coupled engines, 15 or 16 tons per axle was looked on as the maximum. I give here in tabular form the axle weights in their four phases, of the Tank Engines under discussion.

No. of Engine.		Date.	Leading Axle.			Driving Axle.			Coup. Axle.			Trailing Axle.			Total.		
			Tons	cwt.	qr.	Tons	cwt.	qr.	Tons	cwt.	qr.	Tons	cwt.	qr.	Tons	cwt.	qr.
Fig. 1	1008	1889	13	10	0	16	12	0	15	2	0	10	15	0	55	19	0
,, 2	5	1898	12	6	0	17	6	0	17	6	0	12	7	0	59	5	0
,, 3	816	1905	13	16	0	17	10	0	15	18	0	13	9	0	60	13	0
,, 4	227	1911	12	6	0	19	11	0	19	14	0	14	8	0	66	9	0

On comparing the earlier engines with the latest batch, a merely superficial examination makes it hard to see how ten and a half tons increased weight has been achieved. It is a remarkable feature that these engines have been constructed during the *régimes* of three Chief Mechanical Engineers—Mr. Aspinall, Mr. Hoy and Mr. Hughes—and that so few important alterations in design have been necessary to keep them efficient and up-to-date speaks volumes for the excellence of the original design.

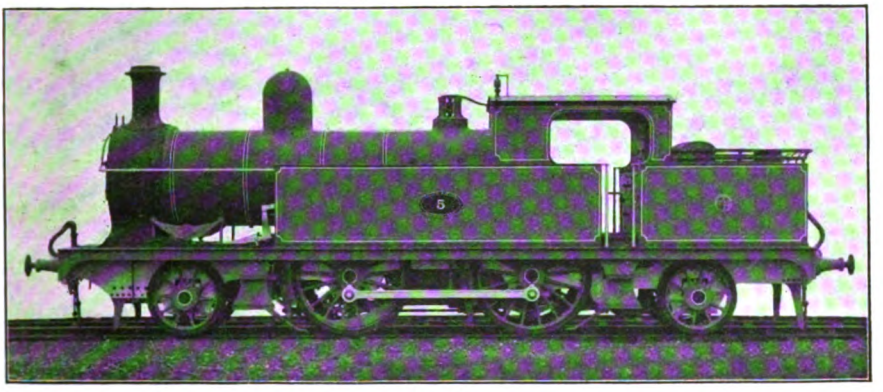

FIG. 2.

To continue in the matter of design, I may add that all engines in Mr. Aspinall's and Mr. Hoy's time had boilers built up from 3 rings, with the dome on the middle one, and had round topped fireboxes, with a level grate of the following dimensions :—Shell 6 ft. long by 4 ft. 1 in. wide ; inner box (of copper) 5 ft. 4⅝ in. long by 3 ft. 6 in. wide by 5 ft. 10 in. deep ; whereas Mr. Hughes' standard boiler is built up of 2 rings, with the dome on the after one, and a Belpaire firebox and sloping grate of the following dimensions:—Shell 6 ft. 4 in. long by 4 ft. 1 in. wide ; inner box (of copper) 5 ft. 6⅜ in. long by 3 ft. 3⅜ in. wide by 5 ft. 11¾ in. high at front, and 4 ft. 6¾ in. high at back. In each case the grate area is, however, the same—18.75 sq. ft.—the reason being, that although there is a gain in length, there is a loss in width owing to

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the widening of the foundation ring. Thus there is an increase of water space at the expense of the grate area. I may add that the Belpaire boilers have 20 per cent. more water space and 40 per cent. more steam space than the earlier boilers. During Mr. Hoy's *régime* six of these engines were fitted with Mr. Druitt Halpin's thermal storage tanks. In his excellent paper read before the Institution of Mechanical Engineers some years ago, Mr. Hughes says of this appliance :—

"Where stopping places are frequent on a rising gradient, there is a distinct economy. Certain tests carried out between Salford and Accrington resulted in an actual saving of one ton of water, and under similar conditions elsewhere the saving was 12 per cent. When, however, these engines have to take their turn on other sections of the line which are not so favourable the all-round economy is brought down to 4 per cent."

fitted to a small cast steel cross stay, bolted at either end to the main frames. This will obviously result in less spindle wear, not to mention advantages to the packing.

And now as to performance. In 1909 Mr. Hughes stated that these engines performed 56 per cent. of the total passenger mileage. At that time there were 270 of the class. So that to-day, on the same basis of reckoning (as there has been no further increase of other Passenger Engines), they must be performing something like 70 per cent of the total. This may sound a remarkable figure to one who is unfamiliar with Lancashire and Yorkshire working, but to one who is, it is easily appreciated. They have few rivals in suburban and country local work. There are 20, 2-6-2 tank engines which share the Oldham, Shaw, Stalybridge and Middleton traffic with them; there are also the remains of Mr Barton Wright's Bogie Tanks

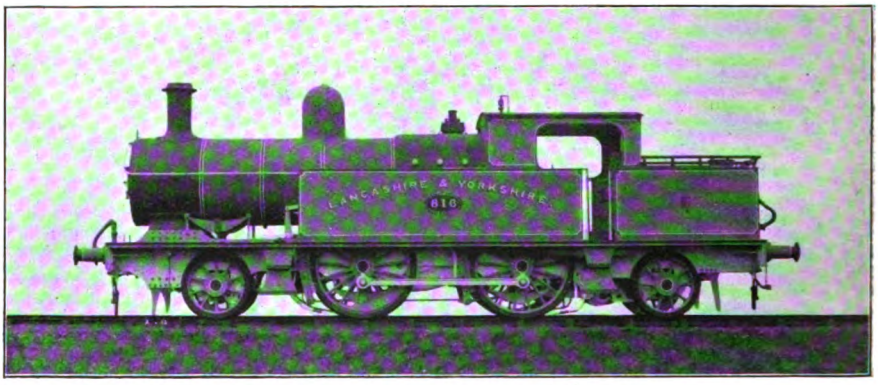

FIG. 3.

All the class have from the first been fitted with Joy's Valve gear, and also Mr. Aspinall's double-ended water pick-up arrangement, worked by vacuum. The first engines had plain D valves. Later ones have Mr. Aspinall's partially balanced back-to-back double valves, and others have Richardson balanced valves. The latest Superheater batch have back-to-back valves. The whole class have leading and trailing wheels (fitted with Webb's radial axleboxes), 3 ft. 7¾ in. diameter, and coupled wheels 5 ft. 8 in. diameter. Up to Mr. Hoy's time all had crank axles forged solid and connecting rods with bolt and cotter adjustment. Since then built up crank axles and marine big-ends have been standard. A recent refinement of Mr. Hughes'—and an excellent one—is the provision of guides and cross-heads for the valve spindles, the guides being

(0-4-4), though but few of these are left, and on several branches there are motor trains. They have no other rivals. There are 31 engine sheds on the line, and I believe none is without one or more of these engines. They are found everywhere on the system and work all kinds of passenger trains.

Their first sphere of usefulness was the Oldham branch, which rejoices in gradients of 1 in 59, 1 in 49, 1 in 60 and so forth, also on the Middleton Junction and Oldham Branch with its famous Werneth incline of 1 in 27 for ¾ mile, which these engines tackle in great style. They also did all the work, both express and slow, on the Liverpool and Southport Coast line until the advent of electric traction on that section. They haul some of the heaviest moderately timed express trains on the system—for example the 4.10 p.m. *ex* Victoria (Manchester) to Southport,

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calling at Wigan and St. Luke's, and allowed 52 minutes for the 35 miles the usual load being 8 bogie coaches (8-wheeled); and the 4.10 p.m. from Manchester to Blackpool (Talbot Road) which is allowed 1 hour and 40 minutes for the 48¾ miles, and stops at Bolton, Chorley, Preston, Lea Road, Salwick, Kirkham and Poulton, the load in this case being rarely less than 10 bogies. In emergencies they have occasionally been called upon to tackle one of the 40-minute Manchester and Liverpool Expresses, when they have behaved with credit to their builders.

They work invariably all the trains on the East Lancashire section from Manchester to Colne and Skipton both *viâ* Clifton, and *viâ* Prestwich. The grading of this line especially in the Haslingden and Accrington neighbourhood is atrocious. They also regularly "horse" the through Euston-Colne trains from Stockport to Colne and *vice-versa viâ* Bolton, Darwen and Blackburn, where they are faced with a gradient of 1 in 74, some 5 miles long in the down direction rising from Bolton to the Sough Tunnel, and a corresponding grade nearly as bad out of Darwen in the reverse direction. They also work with satisfaction some of the intermediate Manchester, Halifax, Bradford, Leeds trains which call at Rochdale, Todmorden, Sowerby Bridge and other stations. But one could go on in this strain for several pages. I should have liked to append a list of these engines, but that also would be too long, as the numbers are mainly non-consecutive and would take up too much valuable space. I conclude by saying that the whole family is doing well, and is, like *Charlie's Aunt*, "still running," with the additional prospect of a further increase in the near future. My thanks are due to Mr. George Hughes, the Chief Mechanical Engineer at Horwich, for having kindly revised this article, and also for supplying the excellent photographs from which the blocks have been prepared.

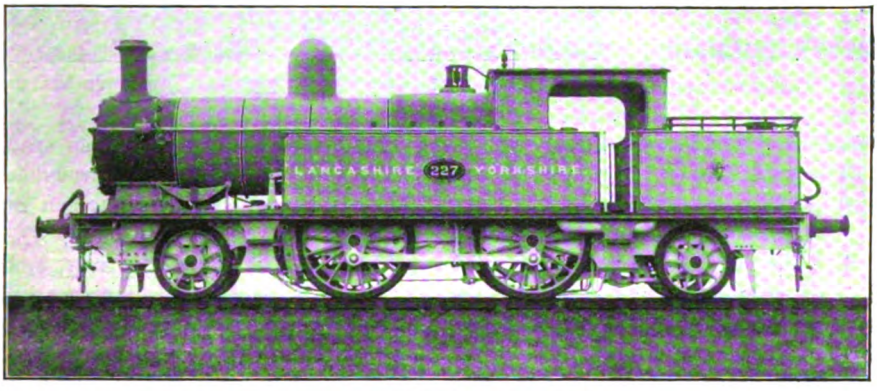

FIG. 4.

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The White Pass and Yukon Railway.

THE GATEWAY TO KLONDIKE.

By
Captain F. E. DOLMAGE.

WHITE PASS AND YUKON RAILWAY, BENNETT STATION.

THIS far-away railroad—which, until two or three years ago when another line, operating a few miles north of it, along the Copper River was completed, had the distinction of being the most northerly railroad in the Western Hemisphere—is a very important link in the chain of communication between the United States of America with its distant territory of Alaska—a vast region comprising half a million square miles. It is also, not inaptly, called "The Gateway to the Yukon," for over it must pass all commerce between the world in general and the great goldfields of the Yukon and Klondike in particular. It is unique in the country it serves, in its geographical position, and in the difficulties of building. Indeed, its construction from Skaguay—the Alaskan seaport situate at the head of the famous "Lynn Canal"—over the summit of the White Pass, to White Horse is claimed to be one of the great engineering marvels of the age. And, as one skirts the rugged mountain side, in deep cutting with over-hanging cliff, in tunnel or snow-shed, or on lofty trestle bridge, one can easily gauge the immense difficulties overcome, especially when one bears in mind the great rigor of the Arctic winter in these parts, and the fact that the construction of the road took little over two years, the line being begun in the spring of 1898, the first portion to Bennett being completed, the golden spike driven on July 6, 1899, the line completed throughout and the last spike driven at Caribou on July 30, 1900.

Composed of railroad, river, and lake travel, it is connected by an ocean journey of a thousand miles with the great cities of the North American Continent. The "White Pass and Yukon Route" comprises four companies, all of which are known by this designation. It is at present the only route from Canada and the United States to Dawson City and the other centres of the Klondike Goldfields, affording transportation all the year round. The railroad division is from Skaguay to White Horse, with a branch line of 12 miles north west from Macrea, and is 111 miles long. The river division, White Horse to Dawson City, is 460 miles long and will, by the close of this year, be extended a distance of 1,000 miles from Dawson City to Fairbanks, making it 1,460 miles in total length. Then the company will have steamers operating this part of the Yukon River. The Lake Division is 85 miles from Caribou to Atlin. From Vancouver in Canada (and Seattle in the State of Washington, U.S.A.), the total distance in miles to Nome on Behring Straits *viâ* Dawson City is about 3,000 miles. This distance at present occupies from 13 to 14 days, but the return journey by the same route would take much longer—about 24 days—owing to the river portion being up

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TERMINUS OF THE LINE AT SKAGUAY, ALASKA.

stream. The return voyage is, however, nearly always made by ocean steamer direct through the Aleutian Archipelago, and this occupies about ten days. From White Horse to Nome is no less than 1,870 miles by the Yukon River, and the journey from Seattle or Vancouver to Dawson City occupies about six days.

From the moment the rich goldfields of the Yukon, Klondike, and Nome were discovered, it became necessary to connect by a line of railroad the ocean port of Skaguay with the Yukon river below the White Horse rapids, above which point the river was not navigable. Hence the construction of the White Pass and Yukon Railroad. The line runs due north, and leaving Skaguay (also spelt Skagway) begins a climb to the summit of the White Pass, 2,885 ft. above sea level, rising to this altitude in a distance of 21 miles. The Skaguay river is skirted almost the entire way to the summit, and the construction of this, the most difficult section of the line to build, was much assisted by the existence of a long cañon or ravine between the mountains, which the railway, always rising, traverses for almost its entire length, when it crosses it on a mighty trestle bridge at a sharp curve, and continues the climb on the opposite side of the valley, by which it reaches the summit, where the British and American flags fly side by side.

Originally there was here a switchback arrangement, which is still to be seen, the railway at that time not crossing the ravine, but traversing it to the end, the direction of the train being then reversed, and the climb continued on the opposite side of the cañon. But the construction of the great cantilever bridge has done away with the old "switchback." Reaching the summit of White Pass, the railway leaves American territory, and enters British Columbia, crossing fairly level, if somewhat desolate, country bounded on most sides by snowclad peaks, to Lake Bennett, which it skirts to Pennington. There it leaves British Columbia, and enters the Yukon territory. Still following the shores of the lake, it reaches Caribou, where the western arm of Lake Bennett is crossed and the Watson river followed, the line later skirting the left side of Lake Lewis. Passing between Mounts Lorne and Golden Horn, it reaches White Horse, a pretty town, built along the west bank of the Lewis river (chief tributary and upper part of the Yukon), and at the foot of some high ground. Starting at a point 8 miles south of White Horse called Macrae Station, a branch line 12 miles long was completed two years ago, running in a north-westerly direction into the White Horse Copper district.

Here I may state that the White Pass and Yukon Railroad is perhaps unique—certainly as far as mileage is concerned—in having been constructed under three distinct charters—one from the American Government in respect of the portion of the line in Alaska (21 miles); one from the British Columbian Government (that province, alone, having been conceded the right of issuing its own charters on entering the Confederation forming the Dominion of Canada) in respect of the 30 miles of it traversed; and one from the Canadian Government for the remaining 60 miles of

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North Bound. No. 1. First Class.	Miles from Skaguay.	Stations.	South Bound. No. 2. First Class.
Leave 9.30 a.m.	0	Skaguay	Arrive 4.35 p.m.
12.05 p.m.	20½	White Pass	3.05 p.m.
1.40 p.m.	40½	Bennett	1.45 p.m.
3.20 p.m.	67	Caribou	11.40 a.m.
Arrive 5.50 p.m.	110½	White Horse	Leave 9.30 a.m.
Read Down.			Read up.

the road, which runs through the Yukon territory. The passenger train service consists, in the summer months, of one train each way daily, Sundays excepted, No. 1 being the north-bound train, and No. 2 the south-bound. Both trains are made up of first class cars and parlour cars.

The table given above shows the principal stations, distances, and times, Alaska time being one hour slower than Pacific, and nine hours slower than Greenwich. Bennett is a meal station for the day trains, which stop there 20 minutes for dinner, a very substantial meal being supplied for 75 cents, or just three shillings. The railway is open for traffic all the year round, and trains run daily except Sundays. Perhaps the heaviest freight traffic into the Yukon is in September, supplies for the winter being then hurried up to Dawson before that season begins. During the winter months each train is generally preceded by a snowplough to clear the way; and when this is considered, it speaks volumes for the care and capabilities of the officials of the line that there never has been any accident on it since it was opened. In the summer time observation cars are attached for tourists, giving them an unobstructed view of the magnificent scenery along the railway.

The equipment of the road is excellent, and the track being well laid and ballasted, the running is smooth. The line is laid on cross sleepers and is narrow-gauge. It is throughout a single line, with passing stations, as, indeed, are most systems in the West of America. First-class day coaches are of the standard pattern in use on all the best American railroads, each car being fitted with lavatories and ice-water fountains, the seats having reclining backs adjustable to the direction in which the train is travelling, the car being mounted on four-wheel bogie trucks. Last summer the company completed some very fine parlour cars which compare favourably with any parlour cars operating on the large railroad systems of North America and which have proved very popular with the travelling public. The locomotives are also very powerful, and of the usual American type and the company now operate two of the heaviest narrow gauge engines ever built by the Baldwin Locomotive Works, of the United States. Trains from Skaguay to the summit of the White Pass are always drawn by two engines; or, as happened on the occasion on which the writer travelled over the line, two freight trains being ready to start at the same time as "No. 1," all three

THE CANADIAN PACIFIC RAILWAY TERMINUS AT VANCOUVER.

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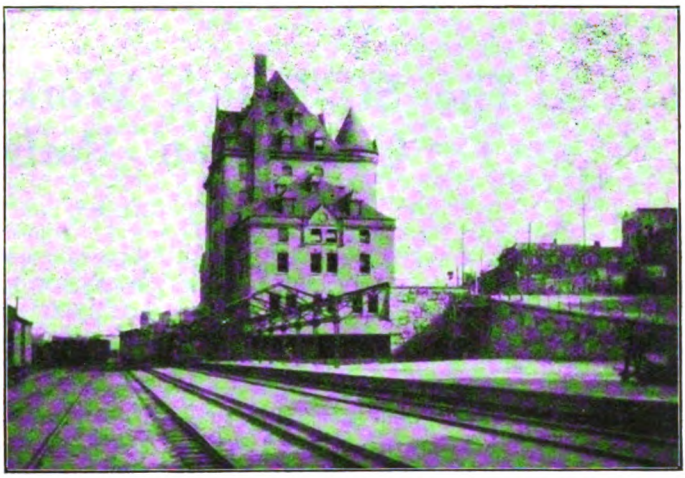
were coupled together, the two freight trains leading, and the passenger train bringing up the rear, this "triple train" having a very odd appearance.

Through the courtesy of the President of the line, Mr. Dickeson, I am able to state that the present rolling stock consists of:

13 Locomotives.
229 Freight cars.
16 Passenger cars.



THE CANADIAN PACIFIC RAILWAY TERMINUS AT VANCOUVER.

There are a large number of bridges, especially on the southern section of the line between the summit of the White Pass and Skaguay. All these bridges were originally built of wood, but they are now being replaced by steel, and where possible, are being filled in and the company has besides completed a number of steel bridges and built a number of concrete retaining walls. Before long, therefore, it is expected that the wooden bridges will be reduced to a minimum. The maximum gradient of the line is 4·30 per cent., and this for a short distance only. The heaviest gradient of any considerable length is 3·90 per cent. Between Skaguay and Bennett—the heaviest part of the road—a 56 lb. rail is laid, and between Bennett and White Horse a 45 lb. rail. The total capitalisation of the line is under two million sterling, all of which is fully paid and issued, being—

In stock $5,684,119.
In bonds $3,648,281.

It would, therefore, appear that the cost of construction and equipment worked out at about £18,000 a mile. On a line which is almost snow-bound for six or eight months in the year, it must be expected that passenger fares will rule high, especially when the total number of passengers carried in a year cannot be very great, and the rate on the White Pass and Yukon Railroad is 18 cents per mile, first-class, that is about ninepence. Tourist traffic is, however, encouraged by the much lower rate of about fourpence a mile. But though these rates may sound to us in England excessive, it must be remembered that here we are dealing with a railroad in a far-away land, in a cold and sparsely populated district, and that at the present time in Dawson City, the metropolis of the Yukon, *the smallest coin* in circulation is the quarter-dollar, equivalent to our shilling. Considerable reductions have been made in the past year in freight-rates on various commodities, especially on mining machinery, thus not alone reducing the cost of living in Dawson and elsewhere, but also enabling mining companies and individuals to put in machinery on ground that had higher rates been charged might have not been profitable to work, and during the past summer the company have had an eminent mining engineer visit as many of the mineral localities along the line as possible with a view to rendering whatever assistance it possibly can to the end that the mining industry along the line may become developed and profitable to the mine owners. Tourists are visiting Dawson and particularly Atlin in ever-increasing numbers. The scenery round Atlin is considered by many the most beautiful they have ever seen (and indeed the writer considered all this Alaskan and Yukon scenery, peerlessly beautiful), and to meet the wish expressed by many who have desired to stop there for a week or more the company are arranging to build a modern tourist hotel at Atlin Lake, which they expect will be completed by next season. A person who finds himself at Vancouver or Seattle in the summer months with time to spare and who wants an interesting experience and a journey through scenery, wild and grand, cannot do better than take the steamer to Skaguay, and travel over this wonderful mountain railway.

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The St. Rollox Works of the Caledonian Railway.

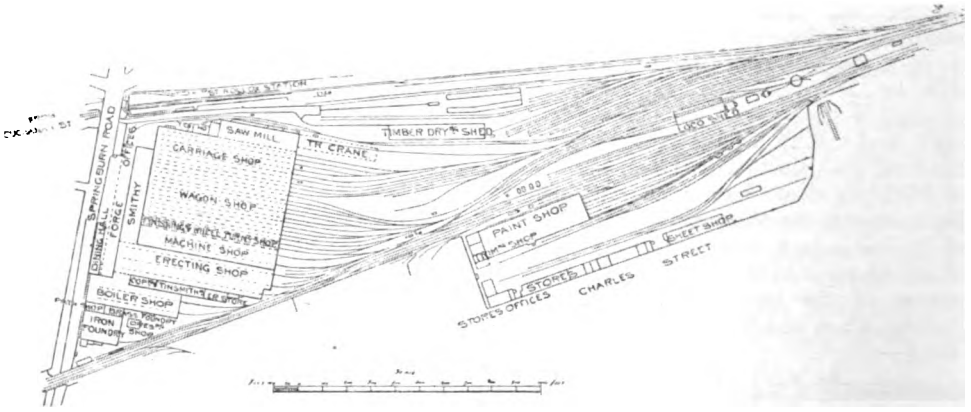
By J. F. GAIRNS.

AS one of the leading railways of Scotland, and as the northern partner in the West coast combination, the Caledonian Railway provides much material of special interest, and a visit to the headquarters of the locomotive carriage and wagon department at St. Rollox, which Mr. J. F. McIntosh has directed since 1895, is therefore unusually instructive, especially as virtually all new construction is there carried on, in addition to current repair and rebuilding operations. Ranking among the most important and complete in Scotland, the works occupy the site of what was originally the terminus of the Glasgow and Garnkirk Railway—the earliest line in Glasgow. The area enclosed now amounts to 24 acres, 13 of which are under cover, and during the times of activity over 3,000 workmen are employed.

Situate alongside the main line from Buchanan Street to the north, close to St. Rollox station, the workshops were built in 1882-84. At the outset the best and most modern principles of shop lay-out and equipment were followed, and valuable additions of tools from time to time have kept them thoroughly up-to-date. Speaking generally the works can produce on an average 50 new engines, 100 new carriages and 3,000 wagons in twelve months, as well as deal with all current repairs, reconstructions and other work incidental to the rolling stock. In addition, mechanical work is undertaken in connection with the canals and docks owned by the Caledonian Company and with the telegraph, signal and other departments.

Throughout the establishment electricity is used for shop driving, current at 6,000 volts being supplied by the Glasgow Corporation to a sub-station, where it is transformed to 500 volts. In most cases the machinery is group-driven, the shafting and belting erected when steam was used being retained. A few of the heavy machines, as well as overhead travelling cranes are, however, direct driven. Narrow gauge tramways facilitate the transport of parts and materials, and in and about the various shops standard gauge lines are laid. Some of the shops are lighted by electricity, others by incandescent gas. Hydraulic power is obtained from the Glasgow Corporation for serving cranes, wheel and flanging presses and other appliances.

The offices are contained in a building which fronts Springburn Road. On the



GENERAL PLAN OF THE LOCOMOTIVE, CARRIAGE AND WAGON WORKS OF THE CALEDONIAN RAILWAY, AT ST. ROLLOX, GLASGOW.

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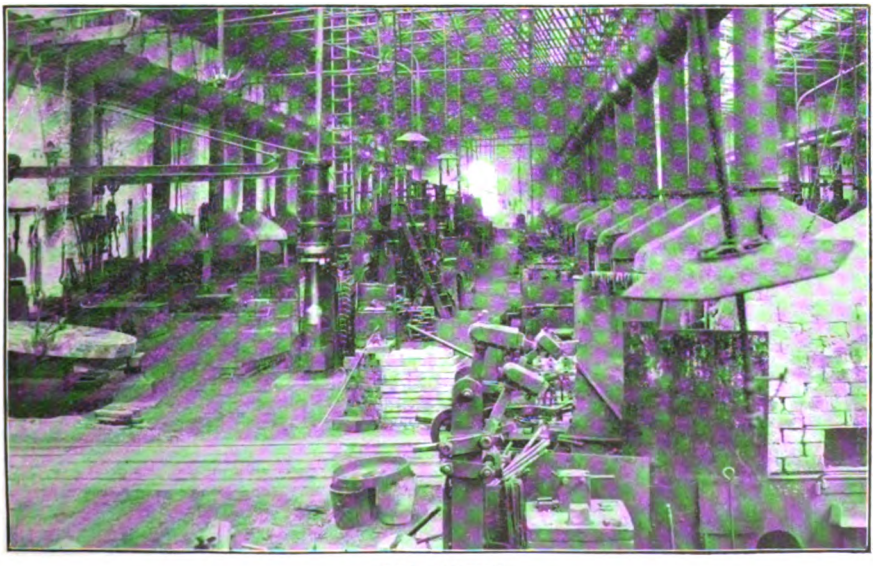
ground floor are the general offices, the Works Manager's office and the telegraph office, while on the first floor are Mr. McIntosh's private rooms, the office of the Chief Running Inspector and the drawing office, the latter being a well-lighted apartment, accommodating 10 or 12 draughtsmen. On the second floor is the mechanical photo-printing department, as well as store rooms for documents and drawings. Close to the offices is the Company's staff restaurant where meals are provided at extremely moderate prices representing in fact only prime cost. On an average 90 employes take breakfast daily, and 140 have dinner, the remainder of the staff, living quite close to the works, being able to obtain their meals at home. Clerks, draughtsmen and foremen have separate accommodation. The kitchen contains the most modern cooking appliances. There is also a reading and smoke room and a lecture hall, the whole premises occupying the area previously used as offices by the locomotive and stores department

Nearly all the work undertaken at St. Rollox is completed under one roof. The forge is mainly open on the side facing the offices, but otherwise it joins the smithy, boiler shop and erecting shop, these being similarly directly connected with the main building and other shops. There is thus a large amount of concentration, and in combination with a complete system of standard and narrow gauge lines, with travelling and other cranes, transportation from section to section is easy and convenient. The forge is 547 ft. long and 40 ft. wide. Along the open side is a range of eight old locomotive boilers, heated by waste gases from the forge furnaces which are, in most cases, placed below. These boilers serve five steam hammers, all of Rigby type and constructed by Messrs Glen and Ross of Glasgow, the respective weights being 15, 20, 30, 40, and 60 cwts. The largest hammer has a hydraulic crane adjacent to serve it. In this section seven forge furnaces are provided, together with a tyre-heating furnace and an oil-fired furnace for supplying a Belville nut-making machine. Among the machines installed here are two hydraulic-presses for forming wheel "vees" used in building up wagon wheels; a wheel spoke-bending machine; a 1000 ton hydraulic press by Hugh Smith & Sons, fitted with an intensifier, whereby the town pressure of 1100 lbs. per sq. in. is increased to 2240 lbs. per sq.in.; a guard plate bending machine; a hot saw for cutting wrought iron; punching and shearing machines by John Yule & Co., Glasgow; bolt and rivet machines by the Bolt Rivet & Iron Co., Charles Miller & Co., of Guide Bridge, and John Belville, Glasgow; a spring cutting machine by Dickenson & Co., Keighley, as well as a Roots blower, two hydraulic and seven hand cranes, and other appliances.

Virtually all the heavy forging is done in this department, and both here and in the



THE SMITHY.

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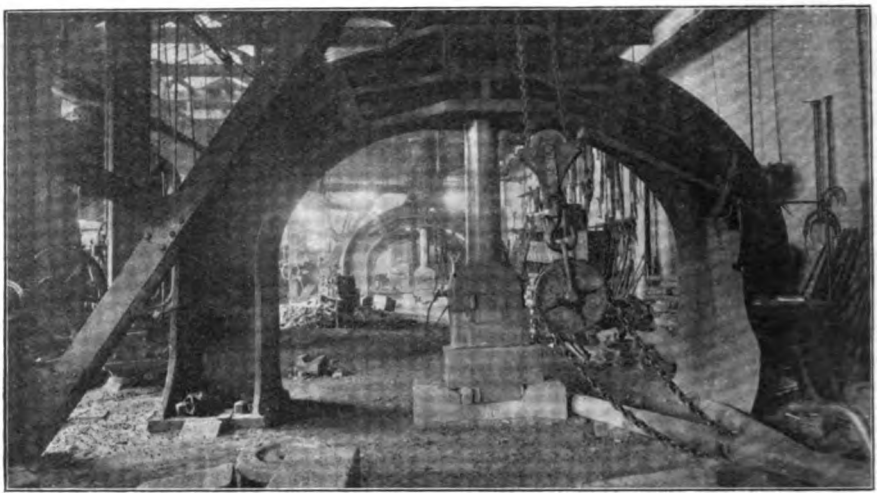

IN THE FORGE.

adjoining smithy "blocking" is extensively adopted. The smithy is 390 ft. long and 75 ft. wide. It has 80 smiths' hearths, the air blast for which is supplied by five Keith and Blackman fans, with 14 steam hammers ranging from 5 cwt. to 7 cwt. (10 by Glen & Ross, the remainder by various makers), and 5 "Olivers" by Allen & Co., Cardiff, for light work. In this shop there is also a hydraulic bending machine, grindstones and polishers, and a number of hand wall cranes. At the further end is the spring shop, with two hearths, a hydraulic spring buckling machine, a spring testing and stripping machine, and a spring furnace. A scrap cutting machine able to shear up to 4 or 5 in. square, and with its own engine underground, may be seen in the same department. The smithy and forge together provide employment for about 260 men and boys.

Before dealing with the erecting and other shops immediately adjacent, it will be convenient to visit the boiler shop, iron foundry and smaller departments contiguous. The boiler shop, 377 ft. long and 97 ft. wide, is well supplied with modern machinery. Two 20-ton overhead travelling cranes there installed are now driven by electric motors, though the transmission ropes and belts used when they were operated from the shop shafting may still be seen. A 25 ft. edge-planing machine by F. Bear & Sons, Sowerby Bridge, may be specially mentioned, together with a Hulse, double-headed shell drilling machine; a G. & A. Harvey double-headed drill for tube plates; a punch by the same makers, capable of taking plates up to 1½ in. thick, for which a separate motor is provided; Hetherington and Whitworth radial arm drills; a milling machine with adjustable circular saw for cutting flanges, and various other drilling, tapping, milling punching, shearing machines. A large plate furnace and a 250-ton hydraulic flanging press are likewise installed. A number of pneumatic tools, fixed and portable, are employed in this department, together with hydraulic rivetters, tube cutting saws, and plate rolls. An enclosure contains a series of machines for making bronze and copper stays, including one by Kendall & Gent, which also straightens and cuts bars before making the stays. A smokebox and telescopic chimney at one side of the shop enables boilers to be tested under steam.

The iron foundry is 158 ft. long and 120 ft. wide. It is served by two cupolas (6 tons and 10 tons per hour capacities) the blast being supplied by a large three-cylinder blowing engine. A 5-ton overhead crane is available. Four moulding machines—three pneumatic and one hydraulic—are provided for repetition work, and a core-making machine with two core-ovens, complete the equipment. The adjoining brass foundry is 79 ft. long by 38 ft. wide; and, as solid gun-metal locomotive axle boxes are used on the Caledonian Railway, it follows that fairly heavy work is here undertaken. There are 14 retorts and one melting furnace, with two compressed air moulding machines, one hydraulic moulding machine, a compressed air crucible hoist and a mechanical fettler. A Sturtevant centrifugal fan supplies air blast to the furnace. On

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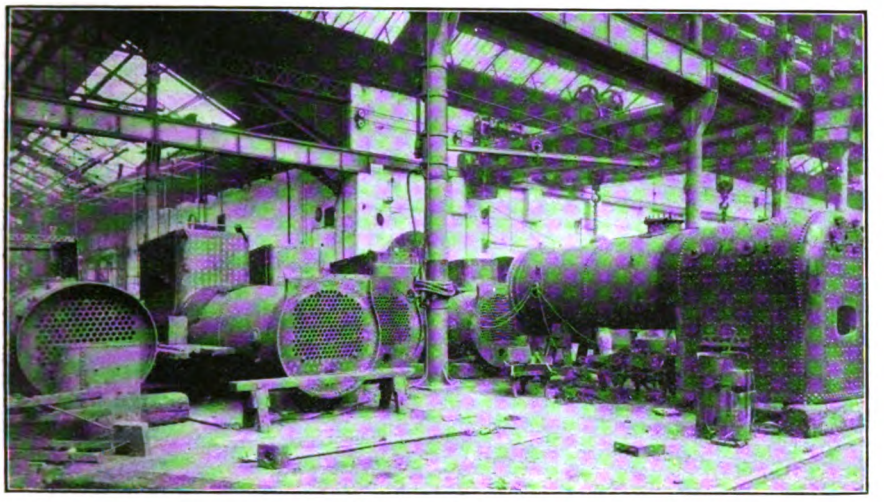
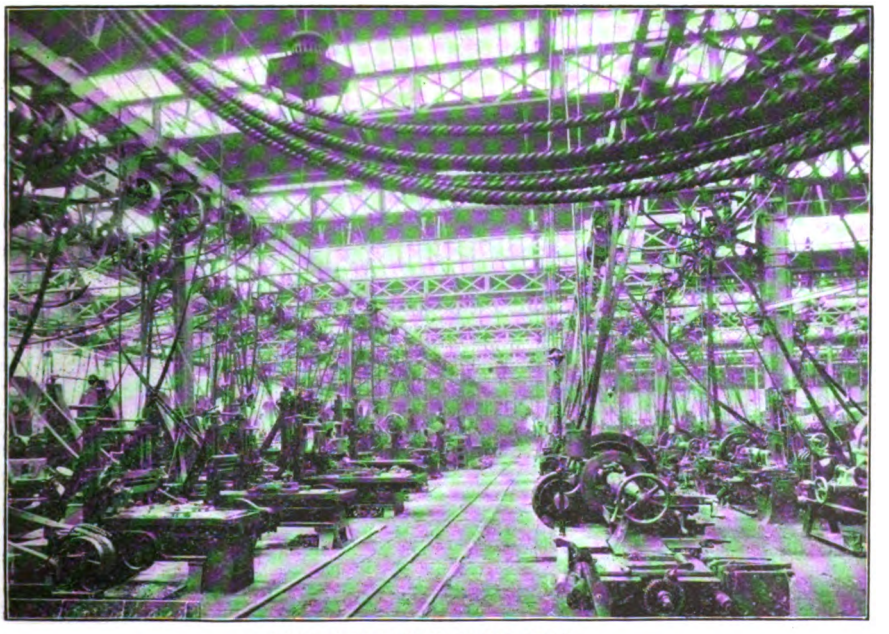


THE BOILER SHOP.

the other side is the copper and tinsmith's shop. This is 312 ft. long and 40 ft. wide, and contains a hydraulic bending press, circle cutting machines, rollers, guillotines, folding machines, multiple punches and blocking out machines, together with tube brazing fires, coppersmith's fires and 14 bolt heating stoves.

The erecting shop is, in many respects, the most interesting part of the works. It is 654 ft. long and 131 ft. wide, and accommodates 90 locomotives and 20 tenders on six longitudinal pits, there being two pits in each of the three bays, with an intersecting road. Each bay is equipped with two overhead 30-ton electric travelling cranes. Pneumatic tools are largely used in the department for drilling, tapping and rivetting, and there are two portable cylinder boring machines. In this section a varied collection of locomotives is often to be seen in all stages of dismantlement or erection,



A VIEW IN THE MACHINE SHOP.

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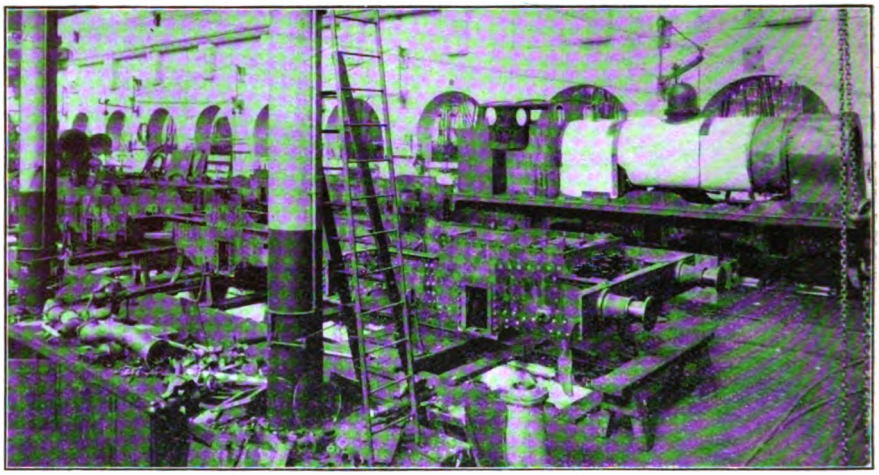
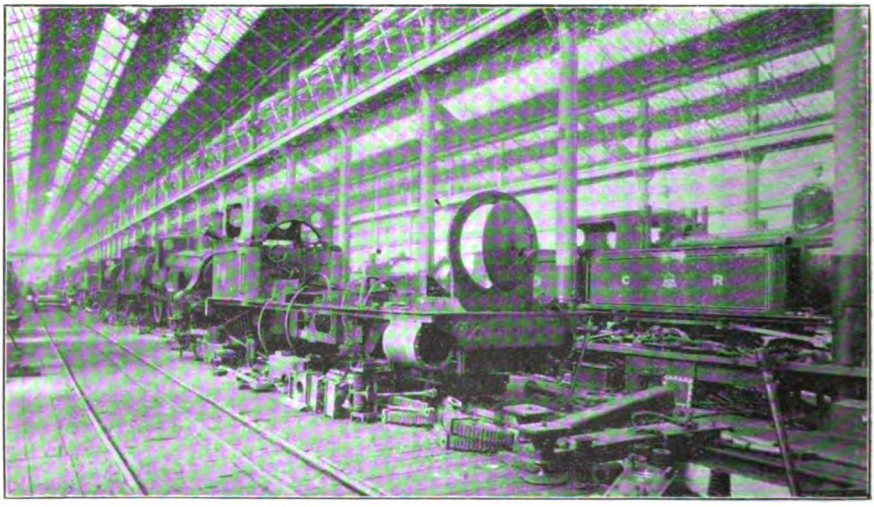


IN THE ERECTING SHOP.

including new locomotives as well as veterans. At the further end of the shop is a pit for testing under steam. An 8-table weighing machine provides for testing and adjusting spring and axle weights. The main building, 577 ft. long and about 500 ft. wide, is divided longitudinally into four distinct sections. Alongside the erecting shop is the machine shop 80 ft. wide, with divisions devoted to brass finishing and fitting. Next is the wheel shop 36 ft. wide, where various heavy machines are installed. The remainder of the building is devoted to wagon and carriage construction.

Speaking generally, the machines installed in the various machine shop divisions are grouped according to class. Thus, in the wheel division there are 6 axle lathes by G. & A. Harvey, Holt, Smith & Coventry, Whitworth & Hetherington. In the machine shop 15 slotting machines of various kinds are found together (J. Shanks & Co., Sharp, Stewart & Co., Holt, and other makers). In another position is a group of 33 small lathes, mostly operated by apprentices, for miscellaneous and general turning. A series of radial arm drills ranging from 4 ft. to 8 ft. radius are placed together, and adjacent is a group of vertical drills of various designs and capacities. Owing to the large number of machines and tools here installed, if is only possible to refer to a few special items.

Several ingenious milling machines



ANOTHER VIEW IN THE ERECTING SHOP.

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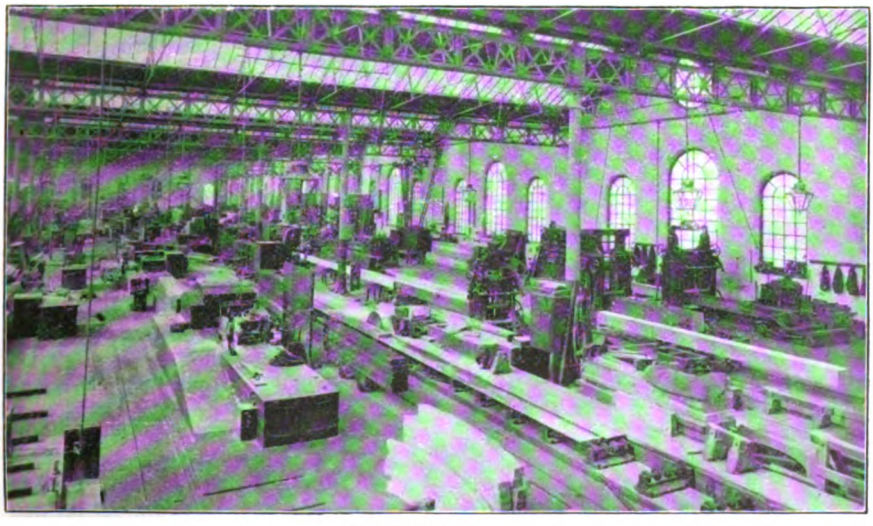
IN THE CARRIAGE SHOP.

by W. Muir & Co., are used, including one designed specially for cylinders, another adapted for milling side rods, and a third for general heavy work. A double-headed traversing drilling machine for cutting slots may also be mentioned. In one division two 6-spindle nut making machines by Fairbairn, Naylor, Macpherson and Co., Ltd., Leeds, turn out about 3,000 nuts per day. A group of nut and bolt screwing machines may also be noted, together with lathes of all designs, makes and sizes, including two new ones by Kendall and Gent; shaping machines having strokes of from 8 in. to 20 ft. (new ones by Cravens and Muir); a double-headed axle box boring lathe by G. & A. Harvey; and 15 planing machines having strokes of from 2ft. to 20ft. by Sharp, Stewart & Co, Cravens, Holts and other firms. A frame slotting machine built by Smith, Peacock & Tannett, with a 34 ft. deck, attracts special attention, especially as it deals with from 8 to 12 frame plates simultaneously.

In the wheel shop various wheel lathes, (including one built by Shanks able to take the 8 ft. 2in. wheels of Mr. Connor's singles); two crank axle lathes, and a quartering machine by Sharp, Stewart & Co., ensuring that holes for coupling rod pins are exactly correct may be mentioned. This section is served by two 5-ton overhead travelling cranes, with 25 hydraulic cranes of various kinds, and a 5-ton overhead crane is outside



THE SAWMILL.

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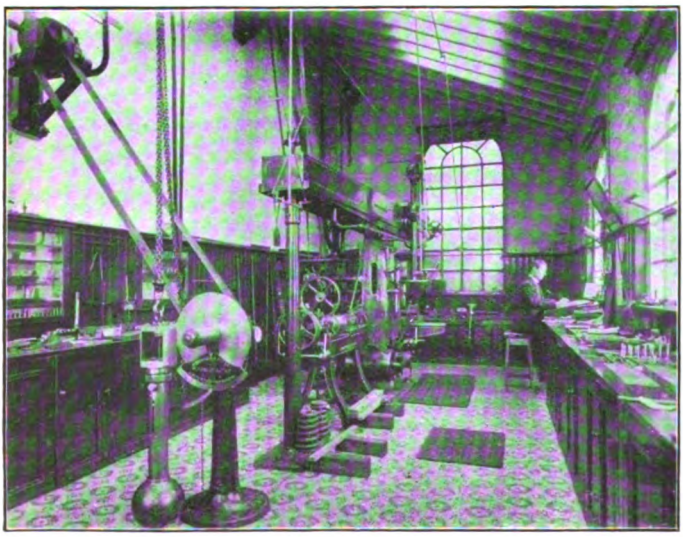
the machine shop to load and unload the wagons, wheels and axles. Three hydraulic wheel presses serve for forcing wheels on to or from axles, and there is a hydraulic press for the tyres of carriage wheels. Two sets of three-throw pumps to supply these presses, two carriage wheel journal lathes, a carriage wheel balancing machine, a bandsaw by Noble and Lund, three cylinder-boring mills, and a "muffled" furnace for tempering purposes are also included in the equipment of this division.

The machine shop proper contains 47 drilling machines, 25 bolt lathes, 36 general lathes, 9 shaping machines, 22 slotting machines, and 14 planing machines, in addition to horizontal boring, milling, nut-tapping, screwing, nut-facing, cutter-grinding, radius brick-grinding and other machines. To many of these reference has already been made. In the brass finishing shop are several turret lathes—mostly American— a shaping machine, two copper stay screwing and chasing lathes, a milling machine, two carriage bush boring machines, two drills, and 14 ordinary lathes. The fitting department contains 20 fitting benches, two motion lathes, and two setting and cut plates. Next to this is the Westinghouse brake fitting shop. The wagon and carriage shops, 372 ft. wide, accommodate 420 wagons on 13 lines of rail and 90 carriages on 6 lines of rail. Adjoining the carriage shop is the cabinet-makers' department, where the finer woodwork for carriage interiors is completed.

The sawmill, forming an extension of the main building, is the most modern part of St. Rollox Works, having been rebuilt a few years ago, after the destruction of the former structure by fire. It is 328 ft. long by 68 ft. wide, having a ground floor and basement, the latter containing all the driving machinery which is almost entirely electrical, small groups of 3 or 4 machines being assigned to each motor, except for the largest machines, which are independently driven. From the drying shed and sawmill yard the timber is brought into the mill at the east entrance by a narrow gauge tramway, where a large 7 ft. cross-cut saw is placed to deal with the heaviest logs without removing them from the bogie. The machines, of which there are 49 in all in the sawmill, include a 42 in. log frame saw; a 16 in. by 7 in. roller planer; a 15 in. by 6 in. planer; 60 ft. and 30 ft. saw benches; sand-papering machines; 32 in. and 24 in. panel planers; facing and edging machines, moulding, morticing, tenoning, drilling and tool-grinding machines, most of the machines being by Thomas Robinson & Co., of Rochdale, or McDowell & Co. Adams' patent pneumatic sawdust collector is installed. The trunk lines of piping are placed in the basement, and branch pipes with collecting hoods are led to every machine. Four fans propel the refuse to a hopper in the collector house, where it is either loaded into wagons or discharged into the furnace of 2 destructor boilers. Oak chips are collected separately, and sold for special purposes. The motive power for the fans is taken from an engine supplied with steam by the destructor boilers.



THE TESTING LABORATORY.

In the yard adjoining the machine shop is the tyre shed. For tyre heating, gas furnaces are used, tyre fitting and stripping being carried on expeditiously by the help of a 5-ton hydraulic crane, while for hammering over retaining rings a pneumatic hammer is driven from overhead shafting. The latest addition to the works is the chain shop, 116 ft. long by 25 ft. wide. Its equipment consists of a 30-ton Board of Trade chain testing

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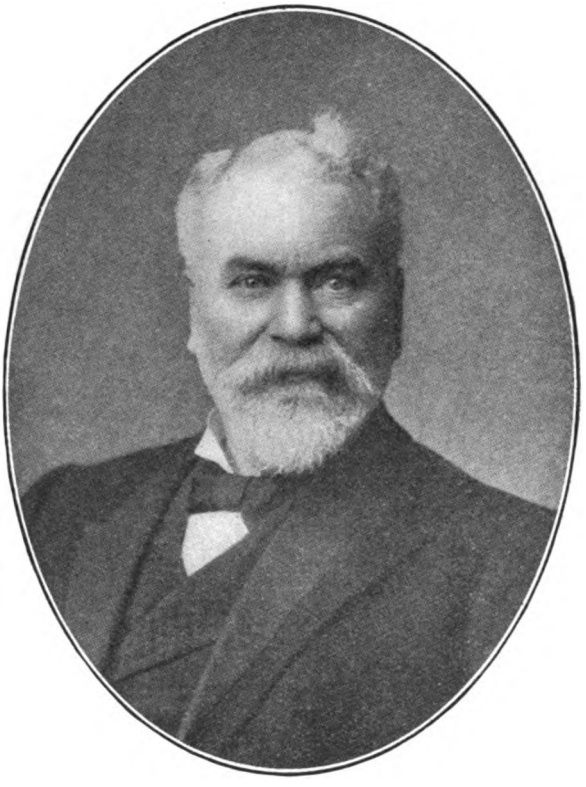
machine, 1 annealing furnace, 1 smiths' hearth, 1 oil bath, fitter's benches, etc. For the convenient examination of chains a pit 2ft. 6in. deep and 50 ft. long is provided, the floor on each side being covered with cast iron plates. The very large number of chains in use for cranes, slings, &c., make this department a most important one in the interests of safety.

Paint and trimming shops are situated quite apart from the rest of the workshops. The former is 451 ft. long by 118 ft. wide, with 5 lines of rails for carriages and 2 for locomotives. It is heated with hot-water pipes, and a small gas-engine grinds and mixes paint as well as driving the machines in the adjoining trimming shop. The latter is 75 ft. long by 54 ft. wide with the usual sewing machines, hair teaser, &c. The test house near the saw mill is furnished with a 50-ton Buckton testing machine with Wicksteed's patent recorder, a Bailey oil tester, and other up-to-date appliances required for a thorough inspection of materials and necessary experimental work.



MR. J. F. MC.INTOSH, M.V.O.
Locomotive, Carriage and Wagon Superintendent, Caledonian Railway.

From the foregoing it will be seen that the St. Rollox Works are extensive, well equipped and conveniently laid out, the last mentioned advantage being the secret of the favourable shop efficiency realised. I am indebted to Mr. J. F. McIntosh, Locomotive, carriage, and Wagon Superintendent, for facilities in inspecting the works, and for various courtesies rendered. Mr. McIntosh, a native of Forfarshire, born at Montrose in February, 1846, entered, when only 14 years, the service of the Scottish North Eastern Railway (which was subsequently absorbed by the Caledonian Railway), and received his mechanical training in their Arbroath workshops. He afterwards qualified himself for working locomotives, and after service as fireman and engine-driver was, in 1876, appointed Locomotive Inspector for the northern section of the Caledonian Railway. Six years later he was made District Locomotive Foreman at Aberdeen, and subsequently promoted to Carstairs Junction, being eventually given charge of the Company's most important engine shed at Polmadie, near Glasgow. After remaining there for five years, he was, in 1891, appointed Chief Inspector of the running department and, four years later—in February, 1895—on the death of Mr. John Lambie, took up his present duties as Locomotive, Carriage and Wagon Superintendent. Mr. McIntosh, was President of the Association of Locomotive Engineers for 1911, and in the same year, His Majesty, King George V., created him a member of the Royal Victorian order.

The following figures show the plant under Mr. McIntosh's charge on the 31st. July last:

Locomotive Stock, 927 Engines.
Coaching Stock, 2,439 Carriages.
Coaching seating accommodation for 109,477 Passengers.
Wagon Stock, 55,607 Wagons.
Wagon carrying capacity, 511,541 Tons.
Average earnings per Locomotive, £4,732 per annum.
Average earnings per Carriage, £744 per annum.
Average earnings per Wagon, £46 per annum.

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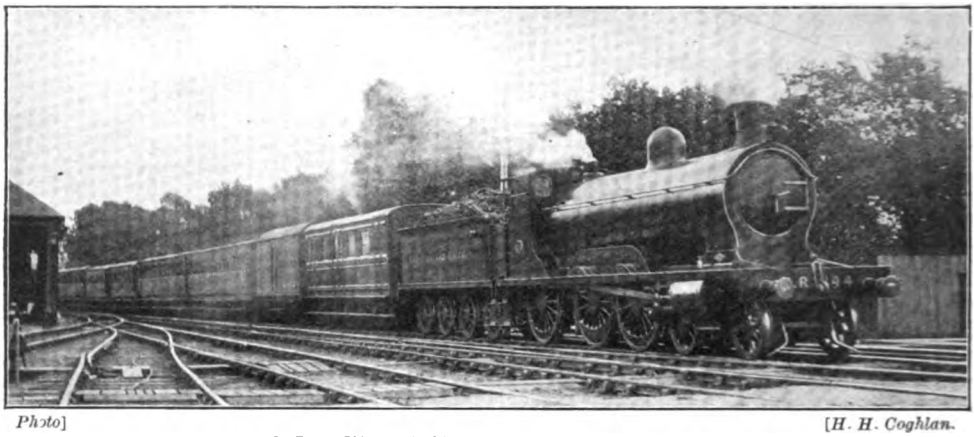

Photo] [H. H. Coghlan.

PERTH-INVERNESS EXPRESS AT PITLOCHRY.
4-6-0 Locomotive No. 144, *Blair Castle.*

The Six-coupled Locomotives of the Highland Railway and their Work.

By B. PURVIS.

THE achievements of the engines of the Highland Railway Company are seldom chronicled in the pages of the RAILWAY MAGAZINE. Nevertheless, they perform splendid work, especially during the summer months when the ordinary trains have to be run in two or more portions, each portion often representing from 300 to 400 tons. As most of our readers know, there are two distinct summits on the Perth-Inverness route. The southern one is at Drummochter, near Dalnaspidal, where, in crossing the Grampians, the line rises to an altitude of 1,484 ft. above sea level. This is the highest point on any railway in the British Isles. To reach the summit from Perth some 14 miles of 1 in 70 have to be surmounted, together with a few miles of easier grades at the foot. To Kingussie the descent is more gradual, but nevertheless as steep as 1 in 50 in places. The other summit is at Sloch'd, beyond Carr Bridge, and is reached from Aviemore by a continuous pull of 11 miles of 1 in 60—1 in 70. The descent into Inverness is terribly steep, consisting of about 15 miles of the same grade.

Accepting the above as facts, one must admit that the work performed in hauling a train of 200 tons without pilot assistance from Inverness to Perth in 3 hours 16 min. for the 118 miles is of a high standard, especially when there are three stops of 5 min. each at Aviemore, Kingussie, and Blair Atholl, making the running time average 40 miles per hour. Yet this is done daily by the 8.40 a.m. from Inverness. The 4-6-0 "Castle" type is the class of engine employed for the through trains and fine engines they are. There are 12 of them named as follows: *Blair Castle, Beaufort Castle, Ballindalloch Castle, Cawdor Castle, Duncraig Castle, Dunrobin Castle, Gordon Castle, Murthly Castle, Skibo Castle, Taymouth Castle, Dunvegan Castle,* and *Urquhart Castle,* They number from 140 to 149 inclusive, and 30 and 35. Four additional engines of the same class are now under construction for next year's traffic. They will be named *Brahan Castle, Thurso Castle, Cluny Castle,* and *Dalcross Castle.*

The Highland Railway has a good many bookings at about 40 miles per hour start to stop. Chief among these are the runs from Blair Atholl to Perth, 35¼ miles in 51 min.; Perth to Pitlochry, 28½ miles in 45 min.; Kingussie to Aviemore, 11⅞ miles in 16 min.; Kingussie to Blair Atholl, 36¼ miles in 54 min., including the whole ascent and descent. The longest non-stop run is made by the 11.50 a.m. train from Perth, Newtonmore, 68¾ miles distant, being the first stop. The time allowed is 6 min. under the 2 hours, and I think I am right when I say that this is probably the only train in Britain which

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rises 1,484 ft. without a stop. Of course, if the train be above the engine load, a pilot is taken in front at Blair Atholl. Other non-stop runs worthy of note are those between Blair Atholl and Perth, 35¼ miles (5 runs daily), best time 51 min.; Inverness to Tain, 41½ miles (twice weekly); Aviemore to Dingwall, 53 miles in 90 min. Inverness is avoided by a loop line, but this run is made on Tuesdays only by the "Strathpeffer" express. When one remembers that nearly the whole of the Highland Railway consists of single line, requiring reduced speed through some stations, and on many curves, these runs are all the more noteworthy.

I will now give a log of two runs which I timed between Inverness and Perth, and part of one in the other direction, unfortunately spoiled in places by waiting at passing stations for other trains.

INVERNESS–PERTH.

	Train	3.50 p.m. *ex*-Inverness.	8.40 a.m. *ex*-Inverness.	3.50 p.m. *ex*-Perth.	
	Engine	*Duncraig Cas.*	*Taymouth Cas.*	*Beaufort Cas.* Loch Moy pilot.	
	Weight of train	175 tons.	170 tons to Aviemore, then 195 tons.	280 tons.	
Miles.		M. S.	M. S.	M. S.	
—	Inverness	0 00	0 00	54 15	= 53·45.
6¾	Culloden Moor	14 40	15 30	45 30	
				40 10	
11	Daviot	23 15	25 30	39 30	Signal stop.
14¾	Moy	31 00	33 45	34 00	Signal stop.
			36 45		
19	Tomatin	36 30	42 30	29 00	
—	Sloch'd Summit	44 35	50 15	25 00	
28	Carr Bridge	50 45	56 35	12 15	
34⅝	Aviemore	58 30	65 00	—	
	Time allowed	62	62	54 min.	
	Average speed	35·51	33·51	38·65	
—	Aviemore	—	—	15 15	
5⅞	Kincraig	9 15	8 15	8 00	
11⅞	Kingussie	15 45	14 20	—	
	Time allowed	17	17	17 min.	
	Average speed	45·24	49·72	46·72	
—	Kingussie	—	—	—	
2¾	Newtonmore	5 15	4 30	—	
13	Dalwhinnie	23 30	20 45	—	
18½	Drummochter Summit	35 00	31 30	—	
20½	Dalnaspidal	37 25	33 45	—	
31¾	Struan	49 10	47 00	—	
36¼	Blair Atholl	54 45	53 00	—	
	Time allowed	56	54 min.	—	
	Average speed	39·96	41·04	—	
—	Blair Atholl	—	—	—	
3	Killiekrankie	5 00	4 30	—	
6¾	Pitlochry	10 15	9 15	41 00	
11¾	Ballinluig	6 00	14 00	34 15	
15	Dalguise	9 30	17 48	30 00	
19¾	Dunkeld	16 00	24 00	24 15	
25	Murthly	—	31 00	17 00	
28	Stanley	—	34 20	11 30	
31	Luncarty	—	39 00	7 00	
35¼	Perth	37 30	44 00	—	
	Time allowed	12 40	51	43 min.	
	Average speed	39·51 45·60	48·07	41·71	

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In the first run *Duncraig Castle* maintained a steady speed of 30 miles per hour up grades of 1 in 80, and only dropped to 25 miles per hour on the stiffer bits at 1 in 60. After Carr Bridge on the descent a maximum speed of 66 miles per hour was attained, the arrival at Aviemore being 3½ min. early. In run No. 2 *Taymouth Castle* was unfortunately stopped by signal at Moy to allow the London train to pass. This check caused fully 4 min. loss, but we arrived just on time at Aviemore. The next short stretch to Kingussie is nearly always covered in great style. *Taymouth Castle* did the last 6 miles to the stop in 6 min. 5 sec., which shows how easily these fine engines can run at high speeds in spite of their small driving wheels.

A contrast will be noticed between the work of the engines over the next section. *Duncraig Castle* kept time by smart running downhill, the speed between Dalnaspidal and Struan—11¼ miles—averaging over 55 miles per hour, and included several slacks round curves and a heavy slack before Struan. *Taymouth Castle*, on the other hand, made a fine ascent. Only on the short stretch of 1 in 50 did our speed drop below 30 miles per hour, and this with 200 tons. However, I think the engine was doing its best. The descent to Blair was very cautious, speed never being higher than 60 miles per hour. From the summit to the stop at Blair Atholl the average was 49.54 miles per hour. Nevertheless, we were in, with time to spare. The last portion of the run, *i.e.*, from Blair Atholl to Perth, usually provides the best average. No. 1 run was made during the winter months, and included the stop at Pitlochry. The 6¾ miles to that place from Blair were covered in 10¼ min. start-to-stop. Leaving Pitlochry, a very sharp descent to Ballinluig was effected in 6 min. for the 5 miles, even time being kept to Dalguise. After Dunkeld I did not take intermediate times, but this run is slightly inferior to run No. 2 over the same section.

In run No. 2 *Taymouth Castle* was doing well over 60 miles past Pitlochry, the 5 mile descent from that place taking only 4¾ min. and from Pitlochry to Dunkeld, 13 miles, 14¾ min., which averages 56·7 miles per hour. On the 3-mile bank of 1 in 80 beyond Dunkeld speed fell naturally, and no high rate was attained until we reached Luncarty, after which station a maximum of 64 miles per hour was recorded. The last 4¼ miles into Perth station occupied only 5 min. 5 sec., including a careful approach. It will be admitted that this run shows admirably of what these engines are capable. The total running time from Inverness to Perth was only 2 hours 53 min.—quite as good as is to be met with over lines far less severe than the one described. On the northward journey nothing very startling occurred. Good running as usual took place between Kingussie, averaging 46·7 miles per hour start-to-stop. A very careful descent from Daviot to Inverness was made, making the arrival practically on time. I have not had the opportunity of timing the large 4-4-0 engines over this route, but I know that they, too, can when necessary do splendid work.

Although the Highland Railway rises to nearly 1,500 ft. above the sea when crossing the Grampian Mountains, and falls to sea level at Inverness, the rough country is not yet left behind, and there is a deal of heavy work to be done in the mountainous country from Dingwall to Kyle of Lochalsh, a few miles from the former place one of the stiffest gradients is met, at Raven's Rock—1 in 50—and there are also several others which test the locomotives to the utmost. In this beautiful country of mountain, moor and lock, more variety of scenery is experienced than on any other railway in Britain. On this journey from Inverness to Kyle the traveller starts in sight of the North Sea, or German Ocean, and is put down within a few yards of the Atlantic. The last 10½ miles, the railway had to be made by blasting the solid rock. The terminus stands almost in the sea, and the buildings for the engine shed, etc., were only made after removing many hundreds of tons of rock. In the summer months, special trains with the most modern carriages are run, when the scenery can be seen at its best. It is a line of continuous curves, and one can constantly see the engine in front without putting one's head out of the window.

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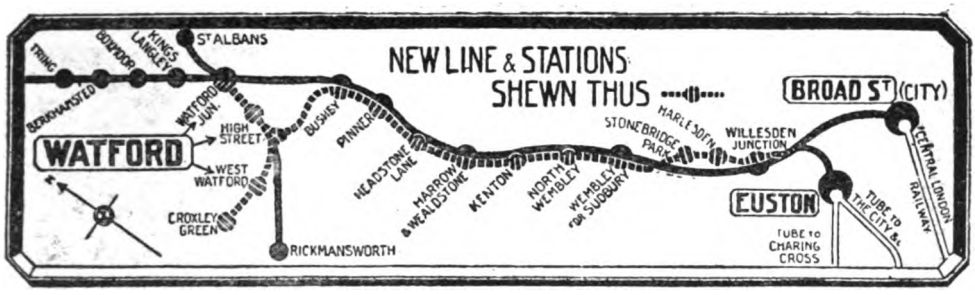

The London and North Western Railway and Watford.

A FEW years ago it was often said that the London and North Western Railway had practically no London suburban traffic, as the North London and Hampstead Junction Railways provided most of the facilities for the outer Metropolitan districts served by the line, while beyond Willesden the stations were so far apart that even Wembley and Sudbury had to be considered as country districts catered for by train services of a semi main line character. But by virtue of the comfort, convenience and expedition of the facilities afforded, the Company have developed a residential business of a special class, and round each of the stations, from Wembley as far north as Tring (and in a small degree even further) there is now an area, inhabited largely by business men and women who travel to and from town daily, but possessing few of the characteristics which are associated with "suburbia" as that term is generally understood. Indeed, whether near or far from the Metropolis, every one of these districts is modern in the sense that up-to-date residential requirements are provided, while picturesque country still remains untouched.

The growth of traffic, encouraged by fast and frequent trains to and from Euston and Broad Street, has for some time severely taxed the capabilities of the four lines of rails hitherto available; and in view of the phenomenal development of the town of Watford, extensive improvements became necessary. As already chronicled in these pages, the work of constructing additional tracks was taken in hand, and at the same time arrangements were made to build extra stations between the older structures. The scheme includes further lines between Euston and Willesden, and to these are shortly to be added the connection from Queen's Park to the Paddington extension of the Baker Street and Waterloo section of the London Electric Railway, so that when the whole of the work has been finished the London and North Western Railway will have one of the most remarkable English suburban systems, concentrating mainly on one direct route. Work is already in progress on the new lines south of Willesden, but it will be some time before the improvements can be finished or the scheme developed, in conjunction with electric traction, to the degree intended. But the completion of the new works from Willesden Junction northwards has enabled considerable advance to be made, and it is with these works that the public are at this stage mainly concerned.

An auxiliary station at Willesden Junction and the new lines thence to Harrow were brought into use on June 15, 1912, some of the North London trains from Broad Street being then extended to Harrow; motor-trains between Willesden and Harrow amplifying the service. On the same date the new branch from Watford to Croxley Green was opened. Hitherto, however, the services provided have been of a tentative character, and it is only now the new lines are completed between Harrow and Watford *viâ* Watford High Street, that any great developments have become possible. The new line was opened throughout as between Willesden and Watford on February 10, when important changes were made, and, bearing in mind that at present only the older lines are available south of Willesden Junction, the additions to the services are remarkable.

The new section diverges from the main lines a short distance north of Kensal Green tunnel, there being through connections thereto from the "fast" as well as with the "slow" lines. Thence it skirts the carriage sidings. Immediately south of the new

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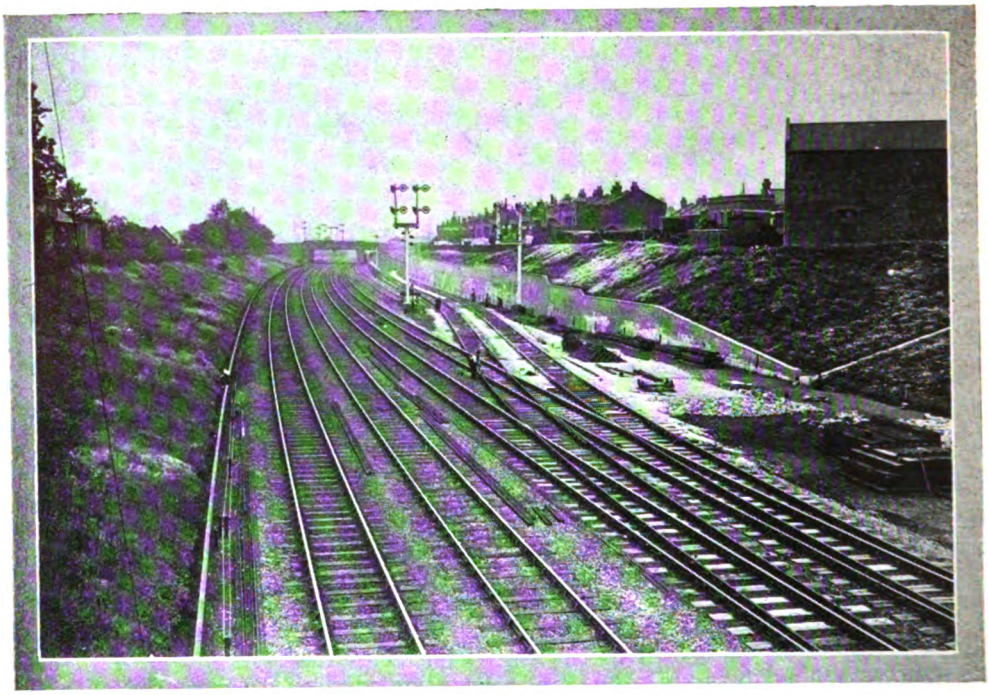
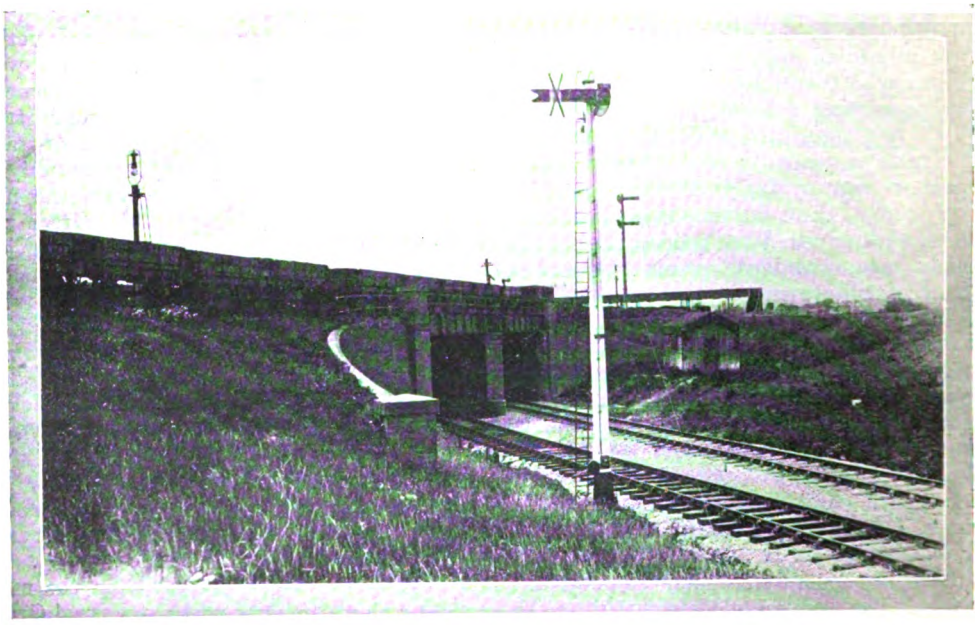


Photo] [*Topical.*

THE COMMENCEMENT OF THE NEW LINES NORTH OF KENSAL GREEN TUNNEL.



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SINGLE LINE UNDERBRIDGES BY WHICH THE NEW LINES CROSS FROM ONE SIDE OF THE MAIN LINES TO THE OTHER.

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station at Willesden Junction a double line connection has been made with the Hampstead Junction line, so that trains from Broad Street will be able to travel over the new lines *viâ* Hampstead Heath, as well as *viâ* Chalk Farm. The station is of the island type, with two bays at the south end. These bays will be available for ordinary terminal work in lieu of, or in addition to, the North London terminal bays in the main station. Continuing northwards, the new lines run practically parallel with the main lines for some distance, although between them are extensive goods sidings and other lines. They then pass under what are known as the "City Goods Lines," and proceed, still some distance away from the main railway, past Harlesden station—a new depôt, already dealing with considerable traffic—and Stonebridge Park—the second new station. A short distance beyond the latter they dip down, and traverse two single-line tunnels, each about 300 ft. long, passing under the main lines and sidings in order to reach the western side of the old railway. Although Stonebridge Park is provided with a commodious goods yard, it has no connection with the new lines, but is served from the sidings.

Beyond the tunnels the lines sweep round, and come alongside the main railway, continuing in that position as far as Bushey. In places the additional tracks are carried on a very low viaduct or embankment, but, speaking generally, they widen the main line to six parallel roads. The old station at Wembley (for Sudbury) has been widened so as to give six platforms, and (except as noted later) similar additions have been made at Harrow and Wealdstone, Pinner and Hatch End, and Bushey and Oxhey. The new stations at North Wembley, Kenton and Headstone Lane have platforms only on the additional lines, and correspond as regards platforms and general design with the two-platform stations at Harlesden and Stonebridge Park. All the new stations are of full length. They have comfortable and well-fitted waiting rooms, booking halls, and lavatories. A neat type of booking office has been adopted, of which North Wembley (illustrated on page 244) may be taken as an example.

Photo] [*Topical.*

THE NEW PLATFORMS AT HARROW AND WEALDSTONE, SHOWING THE MAIN SLOW LINES ON THE UP SIDE AND THE PLATFORM USED BY THE STANMORE BRANCH MOTOR-TRAINS.

At Harrow the new lines pass through what were the main platforms, the express trains taking the old slow lines, while new slow lines, with a side platform for the Stanmore branch trains, have been added on the east side of the railway. This rearrangement has enabled the main lines to be somewhat straightened. Some of the London and North Western motor-omnibus services passing Harrow station

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now stop near the booking office on the down side. On the opposite side a booking office surmounted by a clock tower has been erected, red brick and stone being employed. The coping bears the letters "L. N. W. R." in stone. At Pinner the new booking office on the down side is a picturesque building, with clock tower, and an adjacent shelter reserved for a local cab proprietor is a useful addition. Bushey and Oxhey station has been considerably altered. The new lines as they enter from the south are raised slightly above the main tracks, and then curve round to reach the viaduct, so that the added portion of the station is on a curve diverging to the left from the older section. A wide subway connects the new and old booking offices on either side and serves all the platforms. Electric lifts for luggage and milk have been erected; and in the new booking office is a cycle room where residents and others may leave their bicycles. Several clips are installed for regular travellers, a small fee entitling them to the exclusive use of a clip, of which they retain the locking key. Other clips are available for general cycle storage, under the control of the station staff.

Photo] [*Topical.*

THE BOOKING OFFICE AT WEMBLEY.

The viaduct beyond Bushey station is perhaps the principal feature of the new work. It consists of 17 arches crossing the public road, the river Colne, and its valley. Here the line curves round, and at Colne Junction direct connecting lines have been laid in which will, later on, enable through services to be run between London and the Rickmansworth and Croxley Green branches. At present all trains proceed direct to Watford, *viâ* Watford High Street station. The latter was formerly a small one-sided single-line station situate between high walls, but it is now an island adapted for interchange traffic. Standing in the heart of Watford, it is more convenient than the Junction, and, as most of the local trains now proceed this way, it will undoubtedly become one of the most important on the line. A novel and distinctive feature of this station is the verandah roof, which is carried by girders from the retaining walls, instead of being supported on platform pillars. The booking hall contains a good example of inlaid cabinet work, which, removed from Euston, now partitions off a portion of the hall to form the booking office.

Photo] [*Topical.*

THE BOOKING OFFICE,
HARROW AND WEALDSTONE STATION.

At Watford Junction the local trains are largely concentrated in the new portion of the station on the down side of the main line. Here a terminal island exists, with two bay platforms, so that accommodation for four trains is provided. An additional through line is being constructed alongside the down main platform to connect with the main lines beyond the station; but in the general way the local traffic will be worked quite independently. The new portion of the

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Photo] [Topical.

THE VIADUCT BEYOND BUSHEY AND OXHEY STATION.

station is provided with all ordinary appointments and conveniences; but though actually distinct from the main structure, the whole is conveniently arranged, and even when changing from a London suburban train to the St. Albans branch, the distances to be traversed are only such as are inevitable in a station with 11 platforms—the number which will be available when the work is finished. As it is, the connections with the Rickmansworth and Croxley Green trains are convenient, but in most cases the transfer for passengers who change is now made at Watford High Street station.

The new lines from Willesden are, to a considerable extent, worked as distinct from the older railway, with independent signal boxes. Signals have the familiar ringed arms where the lines run parallel with, and are adjacent to, the main lines, but where they are removed therefrom the usual plain arms are adopted. This is in accordance with the standard signalling arrangements on the

Photo] [Topical.

WATFORD (HIGH STREET) STATION, SHOWING ROOF SUPPORTED BY GIRDERS FROM THE SIDE WALLS INSTEAD OF BY PILLARS ON THE PLATFORM.

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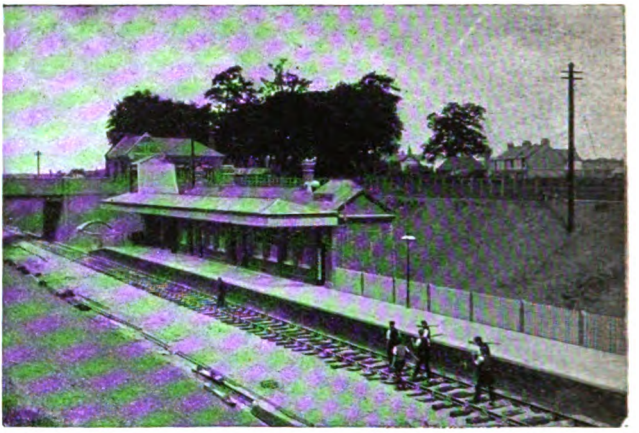
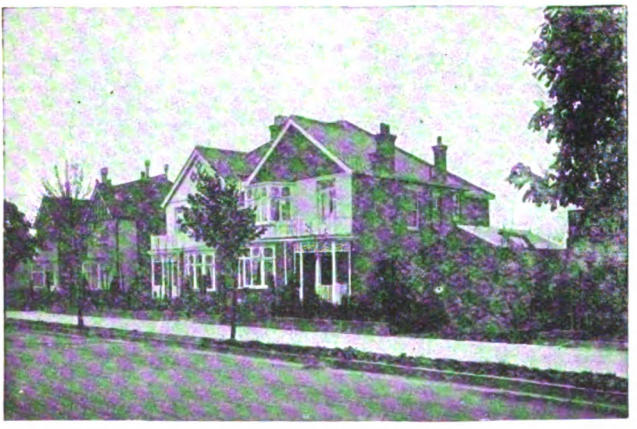
London and North Western Railway for slow or relief lines, and the principle is plainly to be seen at Bushey and Oxhey station, where the signals at the south end are ringed, whereas those at the north end are plain, this being justified in the divergence caused by the curving platforms. The branch from Watford Junction towards Rickmansworth was single track, but it has been doubled through Watford High Street to the junction for the Croxley Green branch. Beyond, both sections are single, controlled by electric train staff apparatus. The Croxley Green section includes one intermediate station, Watford West, consisting of a single platform and one running line. It is a pretty little station, pleasantly situate in a cutting. Croxley Green has a single timber platform, with neat booking office below. A line to the goods yard curves round beyond the station. Just before reaching the station, the line crosses the River Gade and the Grand Junction Canal, here close together. The girder bridge of three spans, the third crossing a private roadway, has been constructed for a double line, though one is used only as a siding at present.



WATFORD WEST STATION.

As a result of these developments the London and North Western now has a six-track railway all the way from Willesden to Watford, with alternative routes connecting therewith south of Willesden. The provision of additional tracks has enabled the train services to be considerably amplified, at the same time relieving the old slow lines and making them more generally available for goods and mineral traffic. Local trains are kept more distinct from the main line traffic than was possible before. Watford High Street is placed on a direct route to London, and obtains many of the fast business trains as well as the local services. Connections with Rickmansworth and Croxley Green trains are facilitated and expedited, interchange being largely transferred to Watford High Street, instead of at the Junction. What these improvements will eventually produce only the future can tell, but it will not be until electrification is an accomplished fact that all that is intended by the Company will be made apparent. Even now the changes are significant and important, and there is little doubt that, while Watford has grown wonderfully during recent years, and other places on the route have also developed in proportion, the whole of this area will go ahead even more than it has done in the past, becoming one of the favourite residential districts of outer London. The freeing of the main line from local traffic will also permit of still further extensions and accelerations of the long-distance residential



HARROWDEAN ROAD NEW STATION, NEAR WEMBLEY, SHOWING TYPICAL VILLAS TO BE FOUND IN MOST OF THE DISTRICTS SERVED BY THE LOCAL LINES OF THE LONDON AND NORTH WESTERN RAILWAY.

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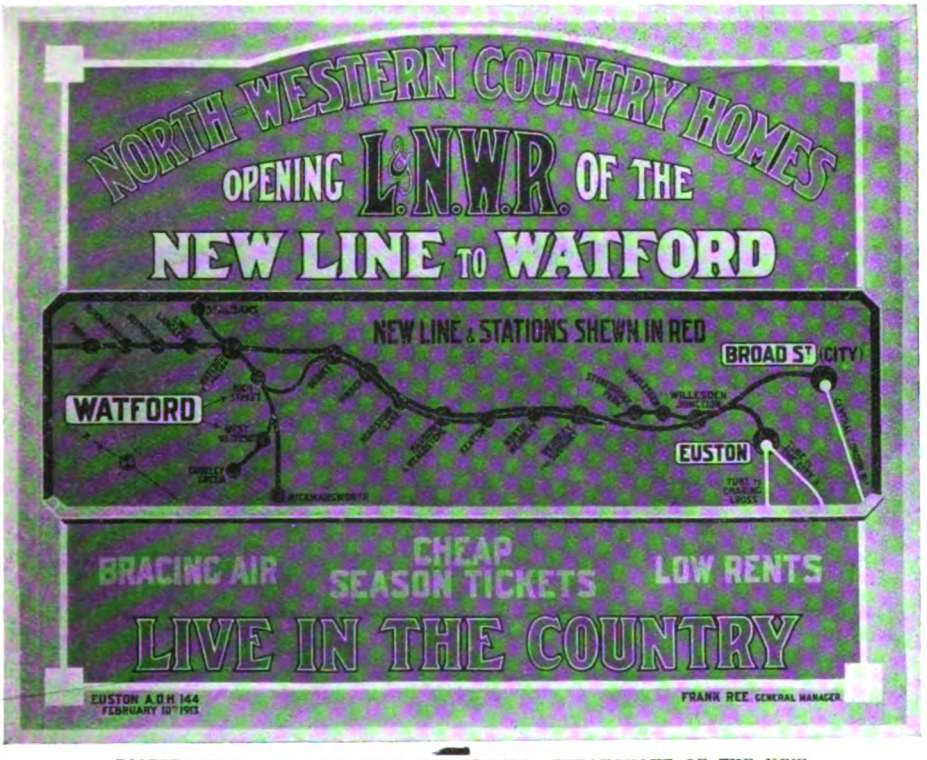
traffic between stations north of Watford and London.

Many alterations have been made in the time-table, and, in addition to the service of express trains, a number of fast trains to and from London are now run, calling only at Watford High Street, Bushey, Pinner, and Harrow. Many of the local trains have been diverted to the new line at Willesden, and call at all or some of the intermediate stations. A "shuttle" service of motor-trains is run over the new line between Watford, Harrow, and Willesden, to give further connection with the main line and the trains to and from the City, Euston, Richmond, Kew Bridge, Hammersmith, and the West-End, *viâ* Addison Road and Earl's Court. Although the new time-table brought into operation on February 10 effected improvements, it is not possible, as already explained, for the Company to carry out their full programme, or to give anything like the service which is ultimately contemplated until the remainder of the scheme has been completed, including the widening between Willesden and Chalk Farm, the new tube line between Queen's Park and Paddington, the electrification of the lines, and the provision of additional platform accommodation at Broad Street.

All these works are in hand. The new platform accommodation at Broad Street is approaching completion; shafts have been sunk, and tunnelling begun for the extension of the Bakerloo Tube to Queen's Park; the ground is being cleared for the widening between Willesden and Chalk Farm, and the contract for the erection of the central power house at Stonebridge Park will be let in the course of a few weeks. The present steam service must, therefore, be regarded more or less as temporary and experimental. It is the Company's intention, as the various works are finished, to gradually introduce further improvements, culminating in the electrification of the whole of the suburban lines, and the running of frequent through electric trains to Broad Street, Euston and the Elephant and Castle, thereby placing the whole of the suburban district served by the North Western line in direct connection with the City, the West and South Eastern districts, as well as with Euston, and affording, by means of



POSTER ISSUED TO ADVERTISE THE OPENING THROUGHOUT OF THE NEW LINES TO WATFORD.

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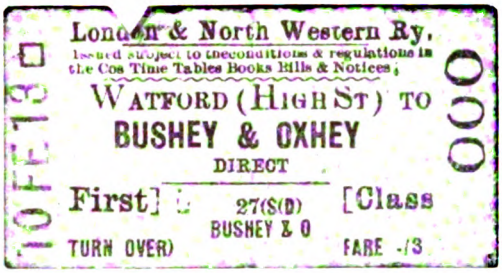
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the Tube interchange stations, connection with the whole network of the Underground Railways to many parts of London.

The gradual provision of these services, and the opening of the new stations at Stonebridge Park, Harlesden, North Wembley, Kenton, Headstone Lane, West Watford, and Croxley Green, will, no doubt, stimulate the erection of house property along the line of route, and induce an increasing population to settle in these districts. Advantages of the frequent trains and quick travel afforded by the electrification should therefore help to check the overcrowding that characterises certain of the more densely populated of the London suburban districts, by opening up various other desirable residential suburbs in localities where an abundance of accommodation is still to be found.

AN EASTER POSTER ISSUED BY THE LONDON AND SOUTH WESTERN RAILWAY COMPANY.

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Central Argentine Railway: Magnificent Family Saloons.

THREE family saloons of a remarkable character have been constructed by the Birmingham Railway Carriage and Wagon Co., Ltd., of Smethwick, Birmingham, for use on the Central Argentine Railway. As the gauge of the system is 5 ft. 6 in., considerable dimensions have been possible, and, as will be seen from the accompanying photographs, the internal equipment and upholstery is in accordance with the most modern ideas of railway comfort and luxury. The leading dimensions of each coach are as follow :—

	ft.	in.
Length over body	68	6
Length over body corner pillars ..	62	0
Width over sheeting	10	6
Height from rail to top of roof ..	13	3
Length over body headstocks	62	0
Length over platform headstocks ..	68	0
Length over buffers	71	4
Width over solebars	9	5¼
Centres of bogies	44	6
Bogie wheelbase..	10	6
Buffer height unloaded..	3	5

The underframes are of mild steel, stiffened and trussed, and the whole of the drawgear is of "special" mild steel. Screw couplings, safety chains, special buffers, and automatic brake fittings are included. The bogies are six-wheeled, the bolsters being supplied with end check springs and rubbing plates. Ascending step boards are of pitch-pine, protected on the edges with brass nosing plates. The wheels are 2 ft. 10½ in. diameter, spaced 5 ft. 3 in. apart, and curves of 180 metres radius can easily be traversed. Best pitch-pine has been used for the whole of the body framing, while corner pillars, waist rails and all other visible external work, including door frames, facia boards and external mouldings, are in teak. Floorboards are of red deal in two layers, the top laid diagonally, and the bottom transversely, a quarter inch of felt being interposed. At each end of the saloon a flexible gangway is fixed. Side lights are double, the upper ones on the outside being fixed, while the upper inside and all lower lights slide upwards, the latter having Bedington's spring balances. Made in two parts, with frames and slats of mahogany, to match the interior finish, the louvres are fitted with fine brass wire gauze, secured by brass bindings (silver oxidised), and the upper louvres have sash springs to prevent rattling.

Highly French polished mahogany panels are seen inside the saloons, and to prevent creaking all are bedded upon strips of felt. Similar in character, the mouldings have an antique finish. The observation saloon—always a popular feature in such cars—has veneer quartered panels on the lines of the Georgian style. These are relieved by unpolished mahogany carvings, and the side windows are flanked by pilasters. Silk poplin curtains, trimmed with dark green cloth braid and loops to match, hang in front of the largest windows, while the side windows are shaded by moiré silk valances, lined with satin appliqué embroidery, panelled with dark green cloth braid. Parcel racks of an ornamental design are fitted over each window with hat and coat hooks at either end. The luxury of a coal fire will be enjoyed by those who use the saloons during cold weather. A fireplace with grate has been erected for the purpose, and there is a polished armour bright exterior finish which gives a particularly cosy appearance. The surrounds and hearth are of the best Carrara statuary marble, and the hearth is bedded upon uralite. A polished armour bright stand is bolted to the hearth, and its clips hold poker, tongs and shovel. The bright curb is of pierced armour, and the coal box of polished armour bright plate, all these features being of the Georgian period. An oval mirror forms part of the mantelpiece.

The "furniture" of these exceedingly handsome saloons includes a bookcase, which stands near the fireplace, an oval table and two folding tables, with plate glass tops, and six white cane chairs upholstered in green buffalo hide to the railway company's pattern. Above green linoleum, the floor is covered by green Wilton carpets of superior quality, which form a charming contrast to the white Tynecastle millboard ceiling. Provision is made for heating by means of hot water, and artificial light is supplied by two four-light electroliers fixed in the ceiling. Two table lamps of ornamental design are

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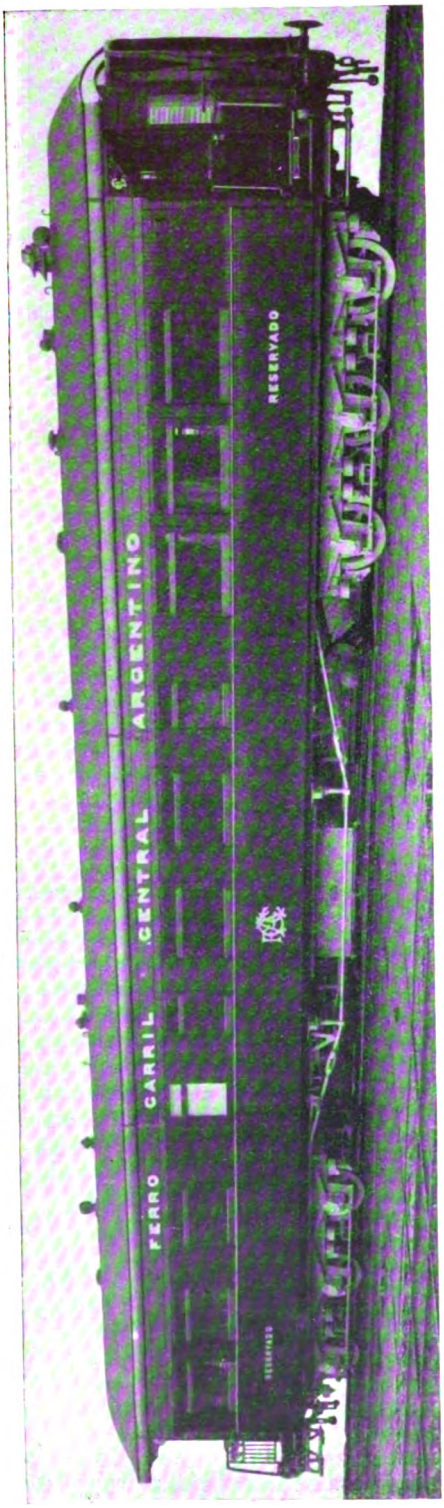

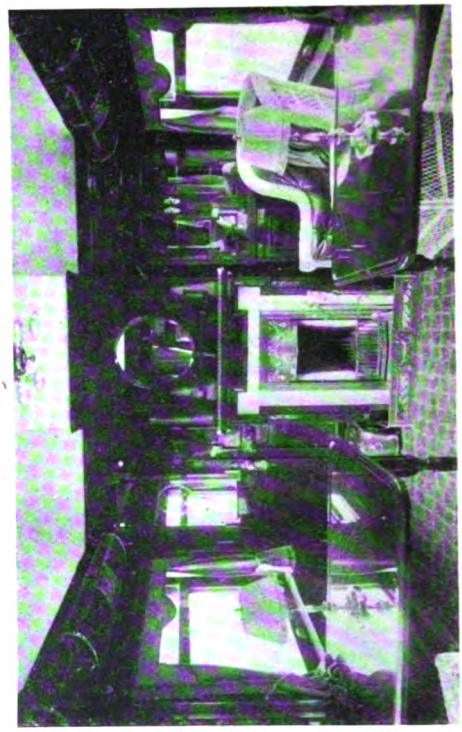

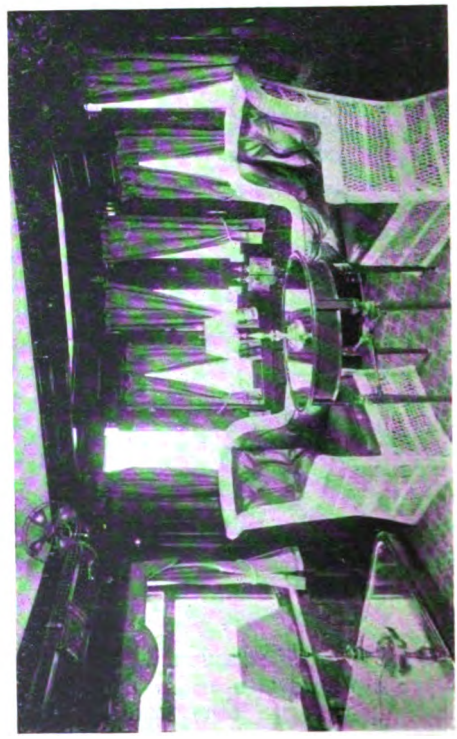

CENTRAL ARGENTINE RAILWAY: NEW FAMILY SALOONS—INTERIOR AND EXTERIOR VIEWS.

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provided, and wall plugs with braided cable enable these to be moved at will from any of the tables. Foul air is removed by an extractor fan with cowl fixed in the ceiling and roof, and two bracket fans, with ornamental trunnion arms, are installed. The whole of the metallic fittings have an oxidised silver finish.

There are three bedrooms, all appointed in the chaste style associated with the name of the brothers Adams, the famous architects of the Adelphi, in the Strand. In the principal bedroom two upper and two lower berths are arranged; the uppermost being fixed to the sides by strong double hinges and supported at the ends by balancing gear. The ceiling and fronts of the berths are protected by padding, and the beds, fitted with the best quality of spring frames, are upholstered in green rexine of an approved pattern, backed with calico, half inch felt and canvas. Hinged clothes racks are fixed above the berths, and the upper tiers are entered by ladders. The lower berths have spring mattresses, upholstered in green buffalo hide, backed with calico, horse hair and canvas. Back and ends are upholstered, and each berth is made to lift up, so that the bedding may be stored in a locker underneath. A bell push is conveniently placed for each berth; a folding table is fixed on the partition between the berths, and above it is an oval mirror. There is a washstand, with silver-plated metal basin in a marble top, and hot as well as cold water is always supplied. A second mirror is fixed over the washstand, and another still larger is seen in the door of a recessed wardrobe. All the berths are warmed by hot water, on the four-pipe system, the pipes being covered as in the observation saloon. A couple of two-light electroliers are attached to the ceiling of the bedroom, single-light brackets being fixed over the oval mirror and the washstand. Ventilation is secured by a roof fan, with torpedo ventilator in the ceiling and roof.

The second bedroom contains two berths—one above the other—a dressing table, with swivel mirror and the necessary drawers, and a double-door wardrobe, the rest of the fittings corresponding with those in the larger chamber. In the third bedroom there are four berths—two upper and two lower. There is another apartment for ladies' toilet, and in addition to lavatories fitted in the most approved fashion, bathrooms with shower baths are available for ladies and gentlemen. The attendant's compartment is finished in mahogany matchboarding, highly French polished, with an antique finish, and his bed is upholstered in green rexine. Linoleum and carpet cover the floor, and the fittings are all that the most fastidious railway servant could desire. The heater chamber is fitted with a slow combustion stove, copper urn, circulating tank and all the necessary piping for a hot water installation. There is also a heating apparatus furnace, and in the roof are two galvanised cold water tanks—one over the attendant's compartment, the other over the gentlemen's bathroom and lavatory—each tank having a capacity for 150 gallons. A dynamo is also installed for electric lighting. The saloon may justly be described as one of the finest in the world. It is, indeed, worthy of the splendid output of the Birmingham Railway Carriage and Wagon Company, Limited, and a credit to British industry.

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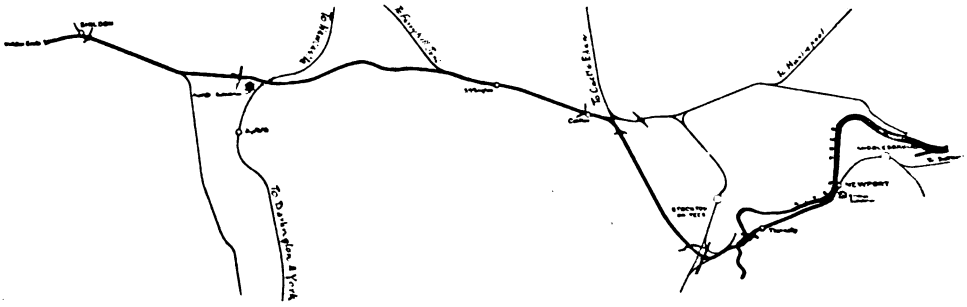
Electrification on the North Eastern Railway.

WE are officially informed that the North Eastern Railway Company have determined to electrify their mineral line between Shildon and Newport (Middlesbrough)—a distance of 18 miles of route, equalling in single track and sidings about 50 miles. A very large mineral traffic passes from Shildon to Newport, the trains averaging over 900 tons in weight. The traffic in the reverse direction is principally composed of empty wagons, and the average loads approach 350 tons. Electrical energy will be purchased from the Newcastle-on-Tyne Electric Supply Company, in connection with the Cleveland and Durham County Electric Power Company and the Cleveland and Durham Electric Power, Ltd. Power will be generated at one or more stations belonging to these Companies as three-phase current, at a periodicity of 40 cycles per second, and transmitted at a pressure of 20,000 volts to two sub-stations situated on the Shildon and Newport line, and at these sub-stations will be converted to direct current at a pressure of 1,500 volts. At this voltage the current will be supplied to the locomotives by means of overhead wires. Ordinary track rails will be bonded for the return circuit.

At places where overhead equipment is difficult, a protected conductor rail will be erected on the track sleepers, and the locomotives will be so arranged as to be able to collect current from this conductor rail when a departure has to be made from the normal method of collecting it from the copper contact wire over each track. For the present, the Company have decided to build 10 electric freight locomotives, and these will be put together in their Locomotive Works at Darlington, where the mechanical portion is to be constructed. The contract for the electrical equipment, such as motors, gears, control equipments, etc., has been placed with Messrs. Siemens Brothers. Each locomotive will be capable of starting and hauling a train weighing 1,400 tons on the level at a normal speed of not less than 25 miles per hour. The construction of these engines will be under the direction of Mr. Vincent L. Raven, the North Eastern Railway Company's Chief Mechanical Engineer, Darlington. The contract for the electrical equipment for the permanent way has also, we are informed, been let to Messrs. Siemens Brothers. Mr. Charles Harrison, Civil Engineer, Newcastle, is the Company's Engineer for this equipment. We also learn that contracts for the sub-station plant have been placed with the British Thomson-Houston Company, and for the transmission lines with the British Insulated and Helsby Cables, Limited. The engineers for the high tension equipment and for the sub-station plant are Messrs. Merz and McLellan, who will also act as Consulting Engineers in connection with the electrical equipment of the locomotives and permanent way. After very careful consideration, the Company resolved to equip this line in preference to others, as the traffic is to a great extent self-contained, and also, because, should the results come up to expectations, an extension of the system of electric working can be readily made in the Middlesbrough and Cleveland Districts. For some years past the Company have had two electrical locomotives working the heavy traffic on the Quayside Tunnel Branch at Newcastle, and these have been particularly successful. But the present scheme is of a much more extensive and important nature.



NORTH EASTERN RAILWAY: ELECTRIFICATION SCHEME.

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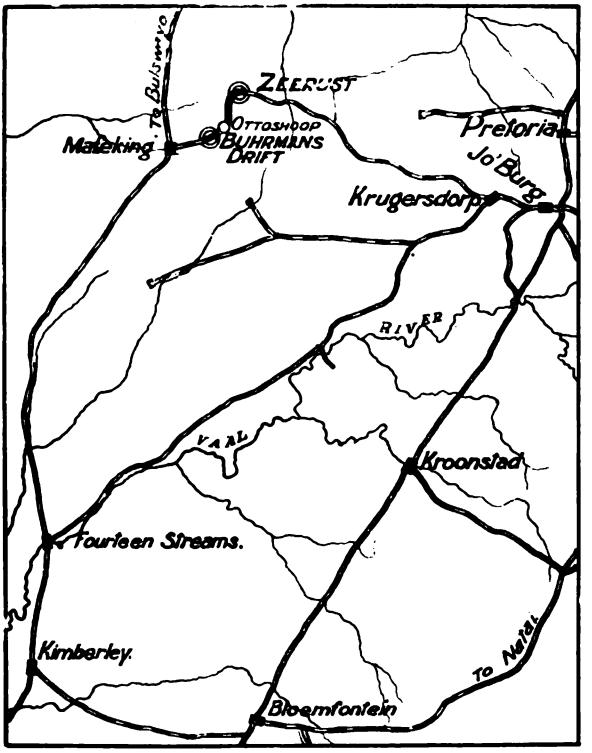
PERTINENT PARAGRAPHS

The Mafeking-Zeerust Line.

ALTHOUGH only 41 miles long, the new Mafeking-Zeerust line has shortened by 247 miles the journey between Johannesburg and Mafeking. Hitherto passengers and goods from the Rand to Rhodesia have had to travel down to Fourteen Streams, a distance of 261 miles, and then turn northward to Mafeking, another 176 miles—making the total mileage, Johannesburg to Mafeking, 437 miles. By the new route Rand traffic (and not alone Rand traffic, but most of the traffic for Rhodesia emanating from the area served by the Klerksdorp—Fourteen Streams line) will go, *viâ* Krugersdorf, to Zeerust, a distance from Johannesburg of 149 miles, and then, by the line just finished, to Mafeking, 41 miles, or 190 miles in all. Laid on a perfectly flat country, says the *South African Railway Magazine*, and with hardly a curve throughout its 13 miles, the Buurman's Drift—Ottoshoop section was as simple a piece of railway work as the district right and left of it is uninteresting. But the concluding section, Ottoshoop to Zeerust, furnishes a remarkable contrast to the preceding one in nearly every respect. The scenery is delightful in its variety, and displays the charming attractiveness of hill and dale, intermingled with well-wooded bits of country and tracts of cultivated and fruitful land. From an engineering point of view, too, the work was entirely different. Much of the 19 miles was laid through rock, and the course of the line consists of a series of well-nigh continuous curves. The steepest gradient is 1 in 60, the sharpest curve having a 10-chain radius. Excavation work was heavy throughout, and not far from Ottoshoop there was half a mile of rock-cutting 28 ft. deep. A 20-metre bridge crosses the Malmani River, and there are several culverts, of 10, 12, and 15 ft. spans. Sixty-pound rails were used.



NEW LINE—MAFEKING TO ZEERUST: SOUTH AFRICAN RAILWAYS.

* * *

White Labour Employed.

ON the Mafeking-Zeerust line white labour was extensively employed, all the earthworks being constructed by white workers. About 50 per cent. of the white labour employed was local, much of it Dutch, and was, on the whole, very satisfactory, most of the labourers proving steady, reliable workers. Their earnings ranged from 4s. to 8s. per day, payment being by results. There is no station between Zeerust and Ottoshoop, but at Jacobsdal (now renamed Lucerne), a few miles from Zeerust, there is a siding, with cattle kraal, goods room, etc., and, as this part of the district includes several fertile and well-cultivated farms, there is every likelihood that a development of local traffic will speedily justify the erection of station buildings. At Windheuvel, near to Ottoshoop, is another siding (a duplicate of Lucerne so far as accommodation is concerned) and at Zendeling's Poort (the first mission station in the Transvaal) there is a halt. The Resident Engineer of the line is Mr. E. P. Popkiss, A.M.I.C.E., and he had with him, as Assistant Engineer, Mr. W. M. Kitto. It is confidently anticipated that the new line will lead to a considerable extension of tourist traffic, particularly in excursions from the Rand to

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Victoria Falls. Local passenger traffic between towns in the Western Transvaal and places in Bechuanaland and Southern Rhodesia will be a factor of some importance, and there is a likelihood of a native traffic of considerable dimensions. About 20,000 natives pass annually to and from the Rand mines. In the past the great majority of these have trekked across country from Mafeking, Labotsi, and elsewhere. The construction of the line may also be expected to affect port traffic. Its opening will bring Durban and Delagoa Bay into much closer touch with Rhodesia. Durban and Delagoa Bay were formerly at greater distances by rail from Mafeking than Port Elizabeth and East London; but the new route will make Durban nearer Mafeking than Port Elizabeth by 37 miles, and nearer than East London by 55 miles, while Delagoa Bay will be nearer Mafeking by 154 miles than Port Elizabeth, and than East London by 172 miles.

* * *

Railway Development in Vancouver.

CAPTAIN FRANCIS D. V. DOLMAGE has forwarded us a copy of the *Daily Colonist*, of Victoria, Vancouver—received from Mr. H. E. Beasley, General Superintendent of the Esquimalt and Nanaimo Railway Company—containing a statement by Mr. D. O. Lewis, District Engineer of the Canadian Northern Pacific Co., in reference to the great railway development entered upon in that city upon what was formerly the Songhees Indian Reserve. The better to illustrate the scheme, Mr. Lewis has prepared a plan showing the projected terminals, wharves, and street connections. The Canadian Northern Pacific Company at present have no trackage whatever in Victoria, but intend to lay out a yard comprising 34 acres, extending, parallel with the Inner Harbour, far into Selkirk Water, opposite Deadman's Island. Already the main lines of the Esquimalt and Nanaimo Company penetrate the old Reserve from Lime Bay to the Johnson Street bridge, and an extensive encircling area is there reserved for the purposes of their yard. Access to the passenger platforms and the lower level of the Canadian Northern Railway station will be given by a roadway, with a gradient of 1 in 24, while the Canadian Pacific platforms will be at the same level as the Johnson Street extension, ample plaza accommodation for waiting vehicles being in each case provided around the buildings. Industrial sites are available between Lime Bay and Victoria Harbour, and adjacent will be a large coal dock and two freight docks. Closer to the Johnson Street Bridge a long passenger dock is to be constructed, and along the Inner Harbour, nearly up to Point Ellice Bridge, land is available for more industrial sites, the whole of the water frontage remaining the property of the Government. A wide roadway will be carried round the greater part of the Reserve, and common-user tracks are to be laid parallel with this roadway for the convenience of the Esquimalt and Nanaimo, Canadian Northern, Canadian Pacific, and any other railways that may in future come to the terminal. If developed to its full capacity, the Canadian Northern terminal alone will deal with 800 cars, without including the coach, repair and engine tracks; and with the system it will be possible to connect the British Columbia Electric tracks with the freight lines of any of the other companies, as well as with the common-user tracks mentioned. This ambitious scheme is being prosecuted with characteristic energy, and in anticipation of its completion, the character of the city has already undergone complete transformation.

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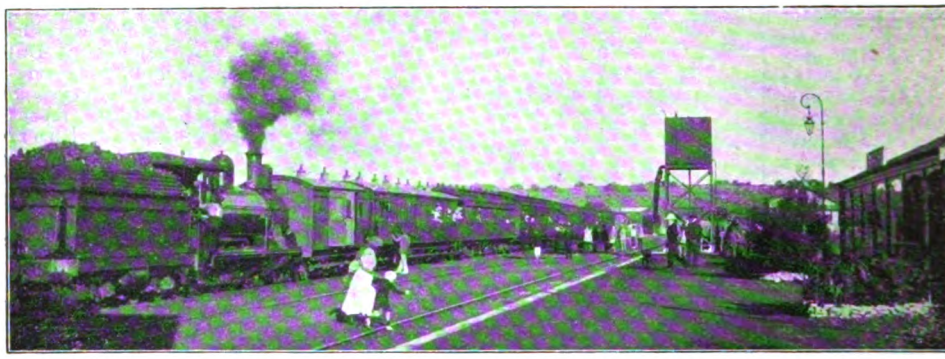

ZEERUST RAILWAY STATION.

New Station at Letchworth Garden City.

WHEN the Garden City was commenced, a temporary station, with timber platforms and buildings, was provided by the Great Northern Railway Company, the intention being to erect a permanent structure, affording increased accommodation as the town developed. The progress of the town has been so rapid that the provision of a new passenger station has been taken in hand, and it will shortly be open for traffic. General plan and elevation of this station are shown by the accompanying drawings. The front elevation of the booking hall block faces the roadway, and the back elevation fronts the station. In character the buildings are in harmony with the general style of structure followed in the town. The booking hall block is on the road level 12 ft. above the platforms, which will be reached by a footbridge and staircases. A booking hall 24 ft. by 30 ft. is provided, and there is in addition a large parcels office and bicycle store. The approach to the station is spacious, and it will be laid out with trees and shrubs in agreement with the general character of the roadways in the Garden City. Up and down platforms will be 600 ft. long with

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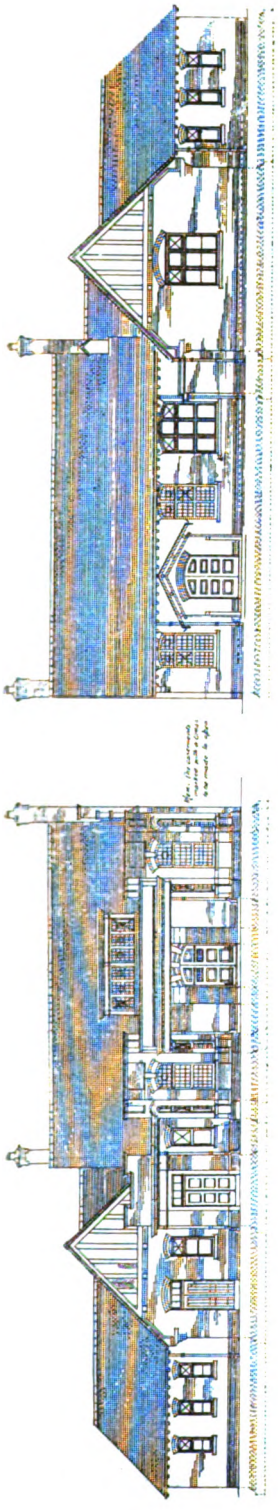

NEW STATION, LETCHWORTH GARDEN CITY: GREAT NORTHERN RAILWAY.

a maximum width of 30 ft. There will be waiting rooms and a platform covering. In addition to the passenger accommodation, considerable extensions are being made to the goods yard with the provision of a large goods shed, stables, and other facilities.

* * *

The Dover-Ostend Mail Steamers.

We are officially informed that the "anti-rolling" steadying tank system of Mr. Frahm is to be applied on the Dover-Ostend mail steamers. This arrangement consists of tanks fitted on both sides of a vessel as far as possible from her centre-line, and communicating with each other by channels of suitably chosen section. The tanks contain a certain volume of water, which is displaced under the influence of rolling. Always tending to flow to the lowest side, the water does not run at once from one side to the other, but "lags" to a certain extent. Consequently, there is always a greater bulk of water on the side of the vessel which is rising. Thus the effect of the weight of water contained in the tanks, if these be judiciously arranged, will approximately balance at each moment the effect of the impact of the waves against the hull of the vessel, which otherwise tends to maintain the rolling motion. The results obtained on several vessels are remarkable, the rolling motion which used to make steamers incline to either side at an angle of from 10 to 20°, is thereby commonly reduced to 2 or 3°. It is anticipated that the new turbine vessels intended for the Belgian State service will be the finest yet built for the Channel, and they are to be the first equipped with the steadying tanks. Improved conditions of crossing may, therefore, be anticipated.

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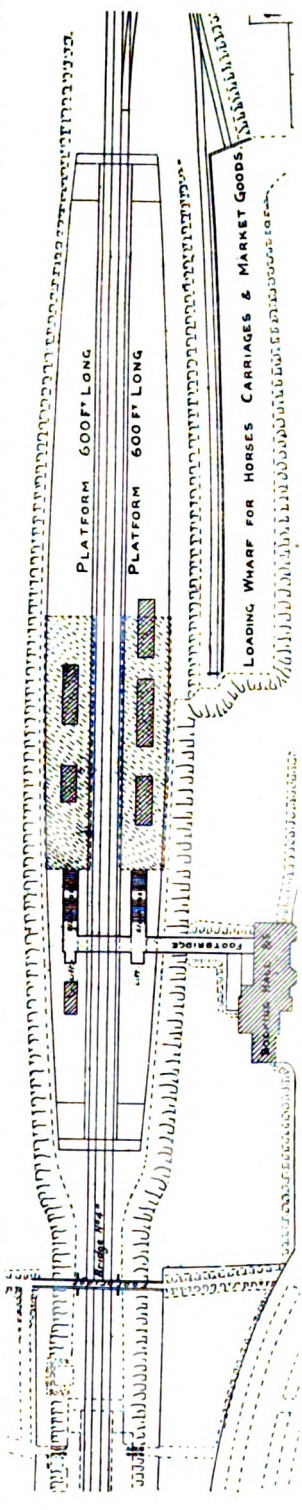
Suburban Traffic on the South Eastern and Chatham Railway.

The successful maintenance of suburban traffic on the South Eastern and Chatham Railway presents a peculiarly difficult problem. Official statistics for



NEW STATION, LETCHWORTH GARDEN CITY: GREAT NORTHERN RAILWAY.

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the year 1912 have revealed the serious fact that there has been a considerable decrease in the number of passengers carried, the whole of which has occurred in connection with the suburban services, and is attributable to tramway and motor omnibus competition. But while the revenue from short-distance traffic was lost, the returns of the past twelve months show an actual increase, of £126,000 the greater earnings coming exclusively from the larger number of passenger journeys to more distant stations, particularly on the Kent coast, and from the Continental services—Folkestone-Boulogne, Dover-Calais, Queenborough-Flushing, Folkestone-Flushing, and Dover-Ostend. These branches of the business, as conducted by the Managing Committee, are uninterruptedly expanding, and it is only natural that efforts should be made to offer every possible facility for continued development in this direction. Electrification would possibly enable the directors to recover much of the traffic that has disappeared from the suburban lines of the separate South Eastern and Chatham sections; but it is by no means certain that the enormous outlay involved in such a proposal could ever be profitable, especially in view of the fact that it would be necessary to provide terminal installations not at two stations—as was the case on the London, Brighton and South Coast Railway—but at six stations, namely, London Bridge, Cannon Street, Charing Cross, Victoria, St. Paul's, and Holborn. This duplication of elaborate plant would, of course, make a considerable difference in the total cost of any scheme of electrification, and the directors are therefore well advised in making the most careful investigation in their power before committing themselves in the matter. It is, however, quite obvious that they are fully alive to the importance of the situation, and the last half-yearly meetings proved that they have the entire confidence of the shareholders.

* * *

The Railways (No. 2) Bill.

In the public interest, the turn events have taken in connection with the Railways (No. 2) Bill is much to be regretted. The Government endeavoured to carry out the pledge they gave to the railway companies when a settlement of the strike of August, 1911, was reached; but at the last moment, during the consideration of the Bill, as it came up in the Commons, on report from committee of the whole House, the Prime Minister made himself personally responsible for the insertion of a new clause the effect of which is to limit the duration of the Act to five years, by providing that at the end of such period its operation can only be continued by the inclusion of the statute in the Expiring Laws Continuance Bill of the year. Thus there has been imposed a condition that formed no part of the bargain entered into between Ministers on the one hand and the chosen representatives of the companies on the other, and in the circumstances it is hardly surprising that there should be accusations of a breach of faith. Whatever may be the result of the trouble, we cannot congratulate the President of the Board of Trade upon the methods he employed to give effect to the pledge of the Government. Instead of submitting at the outset a Bill having only one object in view, Mr. Buxton committed the great mistake of loading the measure with proposals which had no relation whatever to the definite question to be settled. Controversy and opposition on both sides of the House of Commons immediately followed, and in the end, to prevent defeat upon the second Bill, the Government consented to an alteration which has robbed the railway companies of the consideration definitely and specifically guaranteed to them.

* * *

A Rival to the Riviera.

French and Belgian capitalists are combining to make Malaga a serious rival to the world-famous Riviera. The municipality of the Spanish town, vigorously encouraging this spirited ambition, has begun by thoroughly overhauling the sanitary arrangements, in the determination that they shall be equal to anything Western civilisation can produce. Railway development is, of course, also contemplated, and one of the lines projected will connect Malaga with Coin, opening out to visitors the beautiful and fertile region of the Malaga Valley. It is anticipated that this line will be ready for traffic before the end of the present year.

* * *

Railway Platform Tickets.

We are glad to learn that the Great Western Company are extending the "platform ticket" system at their West of England stations. The principle is already in operation at Swindon, Chippenham, and Bath, the date of introduction in the last-named instance being February 6. Costing one penny each, the tickets are available for one hour, and are obtained from automatic machines. We have never yet been able to understand the reluctance shown by railway companies in the United Kingdom to adopt the principle of the platform ticket, which has given such satisfactory results on the Continent. The advantages of the system at all busy stations are too obvious to call for enumeration, and as far as the experiment has gone at Swindon, Chippenham, and Bath, people who wish to accompany friends to the platforms cheerfully pay the penny toll now charged.

* * *

Railway Station Lighting.

Railway engineers engaged in solving the problems that arise in connection with the lighting of railway stations and goods depôts will be interested in the offer made through the Railway Magazine advertisement pages by Pifco, Ltd., of 62, Thomas Street, Manchester, to supply one of their sample lamps for free trial. These gas arc lamps are made throughout of white metal, and so constructed that light and heat are concentrated and kept away from all the working parts of the lamp. A special feature of the Pifco lamps is that mantles or globes can be renewed and adjusters regulated while the lamp is burning.

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THE directors of the London and North Western Railway are to be congratulated upon the results of the working during the second half of the past year, and now that the company are about to cater more vigorously than heretofore for London outer suburban traffic, the financial position will, in all probability, become even stronger in the immediate future. An increase of more than £511,000 was recorded in the receipts from passengers, merchandise, live stock and mineral traffic, and the amount available for dividend was £54,775 more than at the close of 1911. The report contained a generous recognition of the honour recently conferred by his Majesty upon Sir Frank Ree, the General Manager, at which the Directors say they feel sure the proprietors will share their gratification. Mr. E. C. Trench, the Engineer, submitted a useful summary of the works which are in progress upon different parts of the company's system. Steps are being taken to provide improved booking office accommodation in front of Euston station, and for the better arrangement of the dining, refreshment, and tea rooms adjoining the great hall. Having described the new railway to Watford, Mr. Trench stated that materials are being delivered for the electrification of the West London line between Willesden (High Level) station and Earl's Court Junction. The short up loop line at Cheddington to facilitate the working of goods and coal traffic was opened in October last; at Weedon, the up loop line was ready for use; and the construction of a down loop at Welton and an up loop at Stafford will be begun shortly. About one-half of the work necessary for the completion of the new loop line at Coventry (3½ miles long) has been carried out. Progress is being made with the improvement of Walsall passenger station, and portions of the additional accommodation at Monument Lane goods station, Birmingham, are in use. On the widening of the Trent Valley line between Armitage and Rugeley, the earthwork is nearly complete, 6 of the 10 bridges are finished, and the piers and abutments for the viaduct of 4 spans over the River Trent are built. The girders will be erected at an early date. Additional sidings for goods traffic have been brought into use at Bushbury, Bescot, and Aston, and new sidings are being laid in at Stechford, near Birmingham, and at Norton Junction, near Walsall. A portion of the extended siding accommodation at Heaton Norris, near Stockport, has been opened for traffic. New stations have been opened for motor train services at Vulcan, between Winwick Junction and Earlestown, and at Garn-yr-erw, near Blaenavon in South Wales. On the Great Western Joint line, the new coal depôt at Hinderton Field, near Birkenhead, will probably be brought into use in April, and at Rock Ferry station, a bridge is being erected over the platforms and lines for the better handling of passengers' luggage.

* * *

ENJOYABLE evenings are always spent by those who attend the annual Bohemian concerts organised by the Railway Clearing House Athletic Club, and the entertainment given in the Queen's Hall, Langham Place, on February 21st last was certainly no exception to the rule. Founded in 1867, the club is affiliated to the Amateur Athletic Association, the National Cyclists' Union, the Southern Counties Road Walking Association, the London Railways Athletic Association, the London Business Houses Amateur Sports Association, the Royal Life Saving Society, the Amateur Diving Association, and the Southern Counties Amateur Swimming Association. The cross-country headquarters are at the Hare and Hounds, North End, Hampstead. Mr. Charles Mortimer is the president; Mr. J. E. Fullager, hon. treasurer; Mr. H. B. Maslen and Mr. W. A. Palmer, general hon-. secretaries; and J. E. Summers, swimming hon. secretary.

* *

A GRATIFYING account of the position of the Somerset and Dorset Joint Railway was given by Mr. G. H. Eyre, the Traffic Superintendent, at the annual dinner of the general staff, which was held in Bath last month. In proposing "Success to the Somerset and Dorset Joint Line and Parent Companies," Mr. Eyre said the public appreciated to the full the services which the Midland and South Western Companies were able to give. They always received the fullest possible assistance from their Midland friends at Bath, and also from their London and South Western friends at Templecombe. If there should be any friction at any time, the differences were always amicably adjusted, and nothing could be smoother than the working between the servants of the Joint Line and the servants of the Parent Companies. The Joint Line was a most expensive line to work, because of the intervention of the Mendip Hills. Their expenses on that section must be double those of any other company. The coalfields of Somerset were sending out increasing quantities of traffic year by year, finding markets in places where they were never represented previously. The expansion of the mineral traffic during the last ten or twelve years had been wonderful, and there never was a time in the history of the Somerset coalfield when the miners employed were earning such good and continuous pay as at present. The stone industry on the line had also developed to a tremendous extent, the Mendip stone being very suitable for road-making purposes. Roads

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made with Mendip stone and tarred were found to be very successful, and the future of the Somerset stone industry was assured. Therefore, in two great commodities there was a ready sale. Again, their business in milk, butter and cheese, and other classes of agricultural produce was gradually increasing and developing. It was the same with the boot and shoe industry at Glastonbury and Street, and large quantities of these goods were exported to the Cape, New Zealand, and Australia, besides being sent to all the principal towns in Great Britain. During the past two years a very large traffic had been developed in peat, which was obtained from their stations on the moors. In addition the general business was very satisfactory.

* * *

THE Lancashire and Yorkshire Railway Company announce that their service between Hull and Zeebrugge (Belgium) will be resumed by the twin-screw steamer *Duke of Clarence* on Saturday the 31st May, when that vessel will leave the North Eastern Railway Riverside Quay, Hull, at 6 p.m., and return from Zeebrugge on the following Monday at 7 p.m. Thenceforward, until 26th June, the outward sailings will be on Wednesday and Saturday, and from the Belgian port on Monday and Thursday, but from 28th June to 3rd October, there are to be three departures weekly in each direction—from Hull, on Tuesday, Thursday, and Saturday; from Zeebrugge, on Sunday, Wednesday and Friday. In connection with the sailings, through express corridor lavatory trains run to and from the Riverside Quay, Hull, and passengers walk under cover between train and steamer. Those whose destination may be Germany or Switzerland, proceed from the Nord station, Brussels. Their luggage is transferred from the boat train to the service forward, and arrangements made with the foreign railway companies enable travellers at the commencement of their journeys to book through to the principal stations in Belgium, Germany and Switzerland. Those who avail themselves of the tri-weekly service from June 28th to October 3rd, can leave the principal towns in Lancashire and Yorkshire on Saturday afternoon, and, after spending Sunday in Bruges, Ghent, Brussels, Blankenberghe or Ostend, be back at business or home before noon on the following Monday. The *Duke of Clarence*, which has been engaged in the service since its inauguration in 1906, is luxuriously fitted, and provides excellent accommodation for both first and second-class passengers. Dinner is served on the steamer immediately after leaving port in either direction, and, as the sea journey occupies 12 hours, an opportunity is given for a comfortable night's rest in the spacious state rooms. The popular Belgian coast resorts—Blankenberghe, Heyst, Wenduyne, Le Coq-sur-Mer, Ostend, and Knocke—are easily reached by electric trains from Zeebrugge. Mr. A. Watson, Superintendent of the Line, Lancashire and Yorkshire Railway, Manchester, will be pleased to give further particulars respecting the service, and to forward various illustrated pamphlets and continental time tables.

* * *

WE learn that the first steps in an important scheme of re-organization affecting the Transportation Department of the Grand Trunk Railway system took place on January 15th last

THE CURRENT CALENDAR OF THE CENTRAL ARGENTINE RAILWAY.

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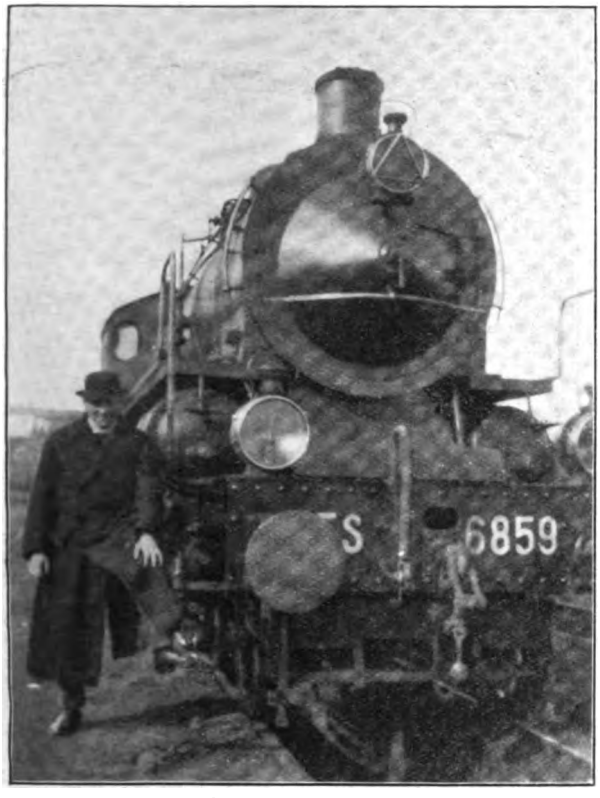

A POSTCARD FROM ROME.
(*Sent by Mr. H. A. Berggsen, Gasaccumulator Co.*)

with the appearance of two official circulars. The first, signed by Mr. Howard G. Kelley, Vice-President of the Department, announces the appointment of Mr. D. Crombie as General Superintendent of Transportation. Mr. Crombie was formerly assistant to the Vice-President. Other appointments are as follow: Mr. C. G. Bowker, Joint Superintendent of Southern Division, to be General Superintendent, Eastern Lines, including Montreal Division, Montreal Terminals, Belleville Division, and Ottawa Division; Mr. H. E. Whittenberger, Superintendent, Middle Division, to be General Superintendent, Ontario Lines, including Toronto Terminals, Hamilton Division, London Division, St. Thomas Division, and Stratford Division; Mr. U. E. Gillen, Superintendent, Eastern Division, to be General Superintendent, Western Lines, including Districts 25, 26, 27, 28, 29, and the Pontiac, Oxford and Northern Railway. The second circular, issued by Mr. Crombie in his new capacity, abolishes the office of Superintendent of Car Service and records the appointment of Mr. W. H. Farrell, formerly Superintendent, Toronto Terminals, as Superintendent of Freight Service; as also of Mr. Fred Price, formerly Superintendent of Car Service, as Superintendent of Passenger Service. Mr. David Crombie, who is thus placed next to the Vice-President in charge of the Transportation Department, was born at Hamilton, Ontario, in 1864, and is, therefore, another of those younger Canadian railroad men who are coming to the front on the great transportation systems of the Dominion. He entered railway service in 1883 as telegraph operator on the Grand Trunk Railway, since which time he has been successively ticket clerk on the same road at Chatham, Ontario, from 1887 to 1889; train despatcher on the same road at London, Ontario, 1889 to 1890; train despatcher, Flint and Pere Marquette Road at Saginaw, Michigan, 1890 to 1892; car distributor, same road, 1892 to 1894; car service agent, same road, 1894 to 1897; and Superintendent of Transportation, same road, 1897 to 1901. He retired to enter private business in 1901, but returned to the Grand Trunk Railway in 1906 as Master of Transportation at London, Ontario. He was Assistant to the General Transportation Manager from 1907 to 1910, and then Assistant to the Vice-President of the Transportation Department.

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THE members of the Permanent Way Institution assembled in force at their annual winter dinner this year. About 140 and a few visitors were present, and a most enjoyable evening was spent under the chairmanship of the President, Mr. George T. Sibbering, M.Inst.C.E., Chief Engineer of the Taff Vale Railway. Mr. L. W. Williams proposed "Success to the Institution." The health of the President was submitted by Mr. John Wilson, M.Inst.C.E., late Chief Engineer of the Great Eastern Railway, whose speech created considerable amusement, in view of his South Wales reminiscences, and his curious arithmetic—invented specially for the occasion. He remarked that the traffic on the Taff Vale Railway "is so voluminous that 450 signal boxes are required, distributed over its 125 miles of line—that is, one almost every 100 yards; and that the dredging account incurred by the company amounts to £181,000 per day!" Mr. Sibbering said he was informed by his chief clerk one morning that a man attached to his department had been run over and lost a leg. "How can that be? I thought he had both legs off four years ago!" was the answer. But investigation showed the report to be quite correct. The man had previously lost both his natural legs, and the later accident had deprived him of one artificial limb! Major Hardy proposed the health of the Past President, to which Mr. D. L. Rutherford, Chief Engineer of the Furness Railway, responded. Mr. Cleaver, Engineer of the Alexandra Docks and Railway, offered the toast of the Executive Officers, and Mr. James Petrie proposed the Visitors, for whom Mr. Philip Dawson, M.Inst.C.E., the well-known electrical engineer, responded. The concluding toast, "Absent Friends," was proposed by the Librarian, Mr. A. G. Pugh, whose speech was one of the successes of the evening. A long and varied programme of musical and humorous items was presented by members and friends, and the evening was brought to a close with "Auld Lang Syne."

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THE twenty-seventh annual smoking concert of the Great Northern Railway Literary Society, held at the Queen's Hall, was most successful and enjoyable. Mr. T. M. Wormald, one of the directors of the company, presided, and during an interval in the excellent programme extended a hearty welcome to all present. Founded in 1854, the society has about 600 members, all of whom are employed on the clerical staff of the Great Northern Railway. Advantages offered to members include a library of 5,000 volumes, a reading room supplied with the leading newspapers, periodicals, and magazines, a large billiard room equipped with three full-sized tables, and a chess and draughts room. The first smoking concert, held in 1887, was on a somewhat small scale, but year by year the concerts have increased in popularity until it has become necessary to make the annual rendezvous the Queen's Hall, other public concert halls being too small for the large number of members and friends anxious to attend. The concert affords an opportunity for pleasant reunion among all grades in the service, and every effort is made to provide an entertainment suiting the tastes of those who look for a bright variety entertainment, as well as those who demand music of a more classical character. In all respects this year's concert was a signal success. Mr. H. Jude was chairman of the concert committee, and Mr. J. B. Costello, honorary secretary.

Photo] [*Elliott & Fry.*

MR. T. M. WORMALD.
Director, Great Northern Railway.

MR. H. JUDE.
Chairman: Great Northern Railway Literary Society Concert Committee.

* * *

VERY satisfactory progress is being made by the undertakings associated under the direction of the Underground Electric Railway Companies of London, Limited. The Metropolitan District Railway continues, it is officially stated, "to show a steady expansion in receipts"; the London Electric Company is in a like position; while the London General Omnibus Company has substantially increased its fleet of motor omnibuses, and shows a satisfactory expansion in earnings. A company formed for the purpose of manufacturing equipment and repair parts for these various undertakings has established a large factory at Walthamstow, and extensive additions are being made to the premises. The Directors of the Underground Electric Railways Company make, in their last report, the further important announcement that most of the securities and shares of the company are now held by British investors. In view of this fact, the American directors have come to the conclusion that the management of the Company

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should in future be wholly in the hands of the Board of Directors residing in Great Britain. They have therefore resigned their seats. Mr. W. M. Acworth and the Right Hon. C. B. Stuart-Wortley, K.C., M.P., have been elected to the Board, and in accordance with the articles of association of the Company they offer themselves for re-election. In parting from their American colleagues, the directors express their high appreciation of the valuable services rendered by them to the company in the past.

* * *

IMPORTANT changes have been made in the directorate of some of the underground railways of the Metropolis. Lord George Hamilton has resigned the chairmanship of the London Electric Railway, and become chairman of the Central London Railway, being succeeded on the former by Lord Farrer. Mr. A. H. Stanley is appointed Managing Director of the Central London and the City and South London Railways, and, occupying, as he does, a like position in connection with the Metropolitan District Company, he will in future exercise governing control over a very large section of the underground railway system of London. Lord Knollys has vacated his seat on the Board of the Central London, and been elected to that of the London Electric, while Colonel Sir Herbert Jekyll (formerly of the Board of Trade) has also become a director of the latter company. Mr. J. F. S. Gooday (late General Manager of the Great Eastern) has resigned as a director of the City and South London, and Mr. T. C. Jenkin, who has retired from the position of General Manager of the City and South London, is to become a director of that company. These and other changes which need not be particularly mentioned may be regarded as likely to effect great improvements in the scheme of underground transport in London and the surrounding suburbs. We may add that W. E. Mandelick has been appointed Secretary of the Central London and the City and South London Railways.

* * *

IN connection with the decision to centre the time-table and control department of the London and North Western Railway upon Crewe, for which the question of building new offices near the station is being considered, the company are adopting the "control" system of regulating traffic. This arrangement has been in use on the Midland and Lancashire and Yorkshire Railways, and to some extent on the Great Western, for some time, with very satisfactory results. The train control is used for goods and mineral traffic, and is worked from a centre with the aid of a graphic train control board, in conjunction with systematic telephonic communication with the principal traffic centres. The board shows on a large scale all the lines, sidings, connections, signal-boxes, stations, and goods yards. Trains are indicated by pegs in holes, and cards are hung on the pegs to show the different kinds of trains. The operators know exactly at any time the position of every train, and what the trains are conveying. Each operator is on duty for eight hours only. Signalmen, stationmasters, and others advise the train controller of every movement, while he in turn gives information and instruction to the outside. In the event of accident, too, the train controller directs trains quickly to other routes. Offices have been opened at Wigan and Prescot, and the system is to be extended, Crewe being the centre of the new department.

* * *

NOTWITHSTANDING the unfortunate strike of the Company's men in the northern district last December, the North Eastern Railway report for the second half of 1912 shows exceedingly satisfactory results, the receipts being £375,643 more than in the corresponding period of 1911. There was an increase of over £202,000 on the expenditure side, but this was mainly due to increased wages, higher prices of coal and materials and payments under the National Insurance Act. The new west entrance to the Hartlepool Docks has been completed, and will be brought into use at an early date. A contract has been let for the construction of a railway from Monkseaton to Seaton Sluice, and a new station at Monkseaton, the estimated cost of the work being £73,000. This railway will be connected with the Tyneside electrified lines, and it is proposed to work it by electric power. A new railway from Stockton to Billingham Beck is proposed, and a widening of the Darlington and Saltburn Railway; also a short railway, to be constructed by the South Yorkshire Joint Line Committee, to Rossington Colliery.

* * *

WITHIN recent years the Caledonian Railway Company have been giving more than ordinary consideration to the development of the longer distance residential traffic between the cities and towns and the many delightful country districts on their line. Additional trains have been run on various sections, and extensive advertising carried out to acquaint the public with the improvement of the facilities and the advantages of country life. The advertising has taken many forms—by posters, bills, newspaper advertisements, and booklets, and in the last-mentioned connection the latest publication, "Free from the Fog Fiend," has been circulated with the object of inducing Glasgow people to reside in Strathaven, a charming country resort only 20 miles away from that city. The aim of the company in issuing "Free from the Fog Fiend" has been to give all necessary and matter-of-fact information regarding rents and assessments, rates for feus or plots, and the cost of living and daily travel, and copies of the book may be obtained on application to Mr. T. W. Pettigrew, General Superintendent, Caledonian Railway, Glasgow.

* * *

THE converted "Atlantics" of the Great Western Company have been re-numbered in the 2,901 series of two-cylinder 4–6–0 express engines, to which class they now virtually belong. These engines were originally numbered 171 and 172, and from 179 to 190. Presumably the eight original two-cylinder 4–6–0 engines, which bore the numbers 98 to 100, and 173 to 178 will also be numbered in this series. No. 4114, *Marlborough*, of the 4–4–0 type, a converted "Badminton," has now been fitted with the standard top-feed apparatus, delivering water into the boiler alongside the safety-valve. Originally the clack-boxes were placed between

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the chimney and the safety-valve casing. The same company are engaged in the multiplication of three of their standard classes of locomotive. Ten more side tanks, with the 2-6-2 wheel arrangement, are to be built, and used chiefly for goods and mineral traffic. Ten additional 4-6-0 express engines with two cylinders (2,901 class) are on order, as well as 10 of the four-cylinder pattern. These engines will constitute additions to the locomotive stock, and not replacements. Their construction is at once to proceed in the order indicated, and it is expected that they will all be ready for the summer traffic.

* * *

MR. THOMAS A. WALKER, the new Secretary of the Taff Vale Railway Company, began his railway career on the Great Western Railway at the age of 15, in 1871, when he entered the Audit Office as a junior clerk. He passed through various grades, and in 1882 was appointed travelling auditor. In 1890 he joined the Taff Vale Railway Company as chief clerk to the late Mr. John Jones, then Goods Manager and Secretary, and continued to occupy that position under him and the next Goods Manager, Mr. James Tilley. In 1907, when Mr. Tilley retired, he was appointed Goods Manager, and remained in that position until chosen by the Board to be Secretary to the company on the 10th of January last. Upon his appointment as Goods Manager he was elected a member of the Goods Managers' Conference, and two years ago became a member of the Claim Arbitration Committee. Mr. P. A. Collins, who succeeds Mr. Walker as Goods Manager, was formerly chief clerk in the same department.

MR. T. A. WALKER.
Secretary, Taff Vale Railway.

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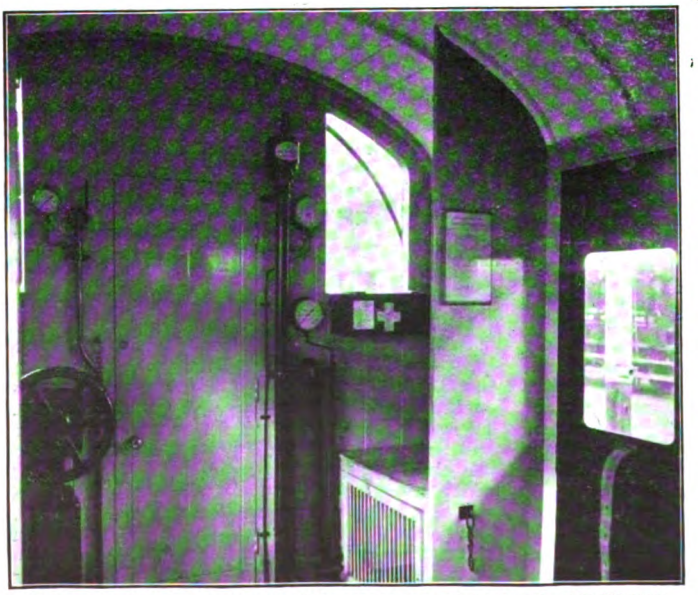
THE London and North Western Railway Company are fitting in each of their corridor brake vans and brake coaches a box containing "first-aid" appliances. The lid of the box is secured by string and a leaden seal, so that the contents may be easily accessible, and a red cross is painted on the front of the box in order that it may be readily distinguished. Main line trains are already fitted with a case of tools and a chemical fire extinguisher. The North Western are to be congratulated on being the first English company so to equip their trains.



AMBULANCE EQUIPMENT AS NOW SUPPLIED TO LONDON AND NORTH WESTERN RAILWAY BRAKE VANS.

* * *

THE passenger traffic (including parcels, etc.) on the Furness Railway shows an increase of 53,913 passengers and £3,733. Passenger traffic, excluding the development of the Lake and Fleetwood steamers, has for some years shown a continuous advance, and since the year 1895 represents an increase of £44,528 per annum—44 per cent. The receipts from the Lake and Fleetwood steamers have decreased by £1,067, owing to the unfavourable weather of the summer months; but the merchandise and mineral traffic shows an increase of 234,767 tons and £25,435. The iron and steel traffic, including raw materials, has increased by 187,859 tons and

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£17,642. Under the arrangements recently made by the four Conciliation Boards in connection with the Company, a total increase in wages has been granted amounting to about £4,700 per annum. These arrangements remain in operation until the end of next year.

* * *

Mr. Alfred Aslett, General Manager and Secretary of the Furness Railway, richly deserved the compliment paid by the members of the local Chamber of Commerce, when they entertained him at dinner in commemoration of the visits which he paid to the East and West when serving as President of that body. It was in the closing months of 1911 and January last year that Mr. Aslett went to see India and Egypt, and in September, 1912, he was the chosen representative of the Chamber at the fifth Annual Congress of Chambers of Commerce at Boston (Mass.). Both missions were undertaken in the interests of the community, and the information which in each case Mr. Aslett laid before his colleagues cannot fail to be of lasting benefit to Barrow and to its railway.

* * *

A souvenir of the jubilee of the Metropolitan Railway has been prepared by Mr. James Feiron, of the publicity and advertising department, from whom copies may be obtained gratuitously. In addition to the official record of the progress of the railway from 1863 to the present year, the brochure contains announcements respecting (1) cheap season tickets which the company issue between all stations, (2) the "limited" season tickets offered to wives and daughters of season ticket holders at half the ordinary rates, (3) the special cheap first-class tickets available for shopping and matinees, (4) the express parcels service which has proved a boon to all residents on the system, (5) the conveyance of farm, dairy and other produce by passenger trains direct to consumers, and (6) the Metropolitan goods station and warehouse in Farringdon Street.

* * *

Those who wish to spend the business half-holiday or the week-end in the country may well be attracted by the cheap travelling facilities offered by the Great Central Railway from Marylebone to the Chiltern Hills and Vale of Aylesbury. In this area is some of the prettiest and healthiest country near London. Walks and cycling runs abound, and the district is well covered with golf links of a sporting character. Popular excursions to the Midlands and the North of England have also been arranged on alternate Saturdays, and tickets at low fares for three, five and eight days are to be issued until the end of this month (March). These cheap facilities are clearly set forth in the A.B.C. Programme, which can be obtained free at Marylebone Station, Great Central Railway Town Offices, or by post from Great Central Publicity Office, 216, Marylebone Road, London, N.W.

* * *

In their report for the half-year ended December 31st last, the Directors of the Great Southern and Western Railway state that it has been found impossible, owing to its constitution, to have the Company's sick fund for employés made an Approved Society under the National Insurance Act, or to re-construct the fund on modified lines, as the unanimous consent of the members necessary to any scheme could not be obtained. Accordingly the Directors decided that the only course open to them was to have the fund wound up in Chancery, and the funds distributed under direction of the court. The Directors, however, have expressed their willingness to facilitate the formation of a new sick fund, and pending this continued the services of the doctors at the company's expense up to the end of last month (February).

* * *

In succession to Mr. Charles H. Dent, Mr. E. A. Neale, Traffic Manager for ten years, has been appointed general manager of the Great Southern and Western Railway of Ireland. Mr. Neale began railway work in 1875, as a clerk in the Irish Railway Clearing House. In 1880 he entered the audit office of the Great Southern and Western Railway, and held several other positions with the Company before being appointed General Manager of the Waterford and Central Ireland Railway in 1895. When these companies were amalgamated, he accepted office as Assistant Traffic Manager and afterwards as Goods Manager.

* * *

The works of the Hull Joint Dock are advancing towards completion, and the lock gates and other equipment are, the Directors state, being pressed forward with a view to the opening of the dock during the current year. Construction of the Gowdall to Braithwell Joint Railway of the Hull and Barnsley and Great Central Companies is also proceeding satisfactorily. The Hull and Barnsley Company has exercised its option of becoming joint owner at Salt End, with the North Eastern Railway Company of the jetty and connecting railway authorised by the North Eastern Railway Act, 1909.

* * *

For the first time in the history of the lines, the station masters in the London district of the South Eastern and Chatham Railway dined together last month at Cannon Street Hotel, under the presidency of Mr. W. H. Hunt, the Superintendent at Victoria. There was a large and representative gathering, including Mr. C. Cox, Superintendent of the Line, the Assistant Superintendent, the District Superintendents, and the station masters at Cannon Street, Charing Cross, Holborn, London Bridge, Herne Hill, Tonbridge, Dartford, Loughborough Junction, Bickley, Brixton, Beckenham, Woolwich Arsenal, Blackheath, Waterloo Junction, Bromley (South), Nunhead, Dulwich, Clapham Road, and Kent House, together with colleagues outside the London district at Dover, Margate, Chatham, Ashford, Redhill, Reading, Reigate, Robertsbridge, and Swanley. The Chairman, in submitting the toast of "Success to the South Eastern and Chatham Railway," recalled reminiscences of railway work 40 years ago, and traced some of the features of transport progress during that period. Mr. Cox congratulated those who had suggested the dinner, and having expressed the hope that it might in future be regarded as an annual event, said he desired to assure all branches of the staff that the directors and officers of the company had the keenest personal interest in their welfare. An excellent

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programme of music followed, and the committee—Messrs. Hunter, Partridge, Lord, Tuck, Privett, and W. Hilder (hon. secretary)—were warmly congratulated upon the signal success which had attended their efforts.

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An increase of ½ per cent. in the dividend declared for the last half year is a substantial indication of the progress which continues to be made by the Great Western Railway. It is officially reported that satisfactory progress has been made with the various works in hand. In South Wales the remaining portion of the Swansea District lines, from Morriston to the junction with the Llanelly Railway near Pontardulais, will probably be available for goods traffic in the coming spring. The construction of the Clydach, Pontardawe and Cwmgorse Railway is about to be commenced; steps are being taken for the acquisition of the land for the Clydach Valley Extension Line; a contract has been let for the erection of a new engine shed at Maesglas, Newport, and provision is being made for dealing with the increasing traffic at the Swansea Docks by the establishment of additional siding accommodation at Briton Ferry Road in proximity to the docks. At Birmingham the widening of the line between Hockley and Soho has been brought into use; the new station at Snow Hill is nearing completion and the works at Moor Street and the widening south of Birmingham are making good progress. Works for extending and improving the accommodation at Paddington are being pushed forward. The goods warehouse at South Lambeth has been completed and brought into use, and a contract let for the construction of the Ealing and Shepherd's Bush Railway.

* * *

The Metropolitan Railway Company announce a series of short trips to the country at Easter. Cheap return tickets will be issued on Thursday, 20th, Good Friday, 21st, Saturday, 22nd, and Easter Sunday, 23rd March, from all Metropolitan London stations, to Chorley Wood, Chesham, Great Missenden, Wendover, Aylesbury, Waddesdon, Brill, and other places, available for return on Sunday, 23rd, Monday, 24th, or Tuesday, 25th March. During the holidays additional relief trains will be run as required for the convenience of passengers, Pedestrian tour and bicycle tour tickets will be issued to those desirous of taking the train to one point and returning from another.

* * *

One of the events of the year at Stratford-on-Avon is the Shakespeare Festival, to be held this year from April 21 to May 10. As usual, Mr. F. R. Benson's Shakespearean Companies will be responsible for the productions in the theatre, and the following plays are announced: "Richard the Second," "The Merry Wives of Windsor," "Henry the Fourth, Part II." (the birthday revival play); "Henry the Fifth," "Richard the Third," "Much Ado about Nothing," "As You Like It," "Hamlet," "The Taming of the Shrew," "Troilus and Cressida," "The Rivals" (Sheridan), "Pompey the Great" (John Masefield), "The Silver Box" (John Galsworthy), and "The Devil's Disciple" (Bernard Shaw). The most direct and quickest route to Stratford-on-Avon is *viâ* the Stratford-upon-Avon and Midland Junction Railway, locally known as the S.M.J. Railway, which connects with the fast dining and restaurant car expresses of the Great Central, Midland and London and North Western Railways. A postcard to Mr. A. E. Diggins, Traffic Manager, S.M.J. Railway, Stratford-on-Avon, will secure a beautifully illustrated guide to Stratford-on-Avon (gratis), together with full particulars in regard to the train service.

* * *

At the meeting of the Railway Club, held at 92, Victoria Street, Westminster, on Tuesday, February 11, the President, the Rev. W. J. Scott, M.A., delivered an address on "Railway History between 1888 and 1900." He dealt with the principal events and to some extent with the secret history of the period, including many reminiscences of important occurrences and associations with well-known officers. An animated discussion, in which Messrs. Bazley (Chairman), Bardsley, Potter, and others took part, followed. Mr. Cecil J. Allen is to read a paper on March 11, his subject being: "The Work of the Great Northern Railway 'Atlantics'—A Critical Survey." Readers who would like to be present are invited to write to the Secretary.

* * *

Orders have been received by the Schmidt Superheating Co, (1910) Ltd., for equipments to be supplied for 15 engines for the Cordoba Central Railway, 3 for the Ceylon Government Railway, under construction by Messrs. Kitson & Co., 10 for the Entre Rios Railway, and 5 for the Indian State Railway, which are being built by the North British Locomotive Co., Ltd. The Schmidt Company have also entered into an agreement with the Railway Administration of the Union of South Africa to fit a large number of engines with their superheater over a term of years. At the present moment 48 engines thus fitted are under construction in this country for the South African Railways.

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A writer in the *Daily Chronicle* says: "The pew as a marketable asset has an interesting illustration in one of the provisions of an early Great Western Railway deed, which conveyed to the company premises at Hungerford with the right to place two horses or four cows on the common and to occupy a pew in the parish church. It is not recorded whether any of the company's staff at Hungerford have made it their duty to maintain the rights to the last privilege."

* * *

Mr. Stanley Baldwin, M.P., one of the Directors of the Great Western Railway, has consented to preside at the 52nd Anniversary Festival of the United Kingdom Railway Officers' and Servants' Association, to be held at the Whitehall Rooms, on Wednesday, April 30th. Mr. Alfred James is the secretary of the Association, the offices of which are at 21, Finsbury Pavement, E.C.

* * *

Sir William J. Goulding, Bart., D.L., Chairman of the Great Southern and Western Railway, has been unanimously re-elected Chairman of the Irish Railway Clearing House Committee for the year 1913.

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ALF COOKE LTD LEEDS

LONDON & NORTH-WESTERN RAILWAY SIX-COUPLED EXPRESS LOCOMOTIVE,
No. 819, "PRINCE OF WALES"

FITTED WITH SCHMIDT SUPERHEATER DESIGNED BY MR. C. J. BOWEN COOKE, CHIEF MECHANICAL ENGINEER.

CYLINDERS, 20½ IN. STROKE, 26 IN. COUPLED WHEELS, 6 FT. 3 IN.

TOTAL HEATING SURFACE, 1897.5 SQ. FT.

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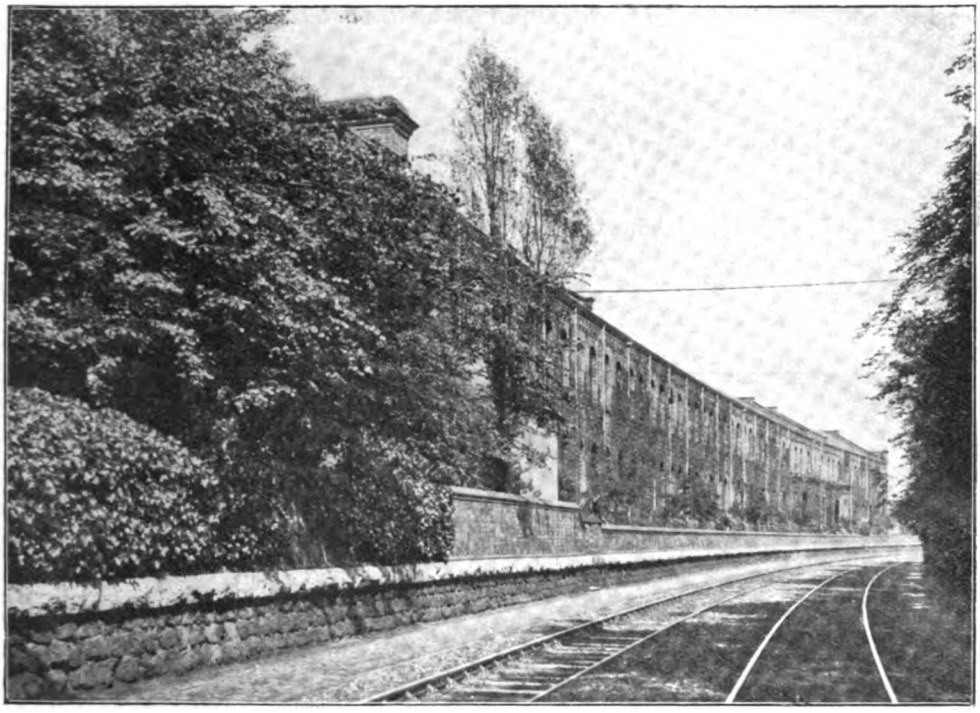

LOCOMOTIVE OFFICES AND ADMINISTRATION BUILDING.

The Most Famous Railway Works in the World:

CREWE—LONDON AND NORTH WESTERN RAILWAY.

By J. F. GAIRNS.

In view of the promised visit of their Majesties King George V. and Queen Mary to the works of the London and North Western Railway at Crewe, a description of that establishment, the most famous of the kind in the world, is peculiarly opportune, and the courteous co-operation and assistance of Mr. C. J. Bowen Cooke, Chief Mechanical Engineer, his principal assistants and other officers of the London and North Western Railway Company enables me to deal exhaustively with the subject.

CREWE is not the only "railway" town in the United Kingdom, but it is, perhaps, more correctly entitled to that description than any corresponding depôt, in that there was barely a village when it first achieved importance, whereas most of the other great railway centres have developed from at least a fairly large township. It is on record that about 80 years ago a solicitor, residing in Nantwich, purchased a piece of land 60 acres in extent, for £35 per acre, called "Oak Farm,' situate near the village of Coppenhall. Even as a speculation the bargain appeared to be a poor one, the nearest town being Nantwich, 4 miles away, and there were in the vicinity only about 27 houses, accommodating 140 persons. The solicitor followed up his purchase by others, until he possessed about 200 Cheshire acres, each acre consisting of 10,240 square yards. No particular scheme of development was undertaken, but there were rumours of railway construction in all directions, and eventually the far-seeing man-of-law found his land in requisition, first by the Grand Junction Railway from Birmingham to Liverpool and then by the connecting lines to Chester and Manchester. A further stage followed when the Grand Junction Company established works at the convenient centre afforded by the junction of these lines, and eventually all the

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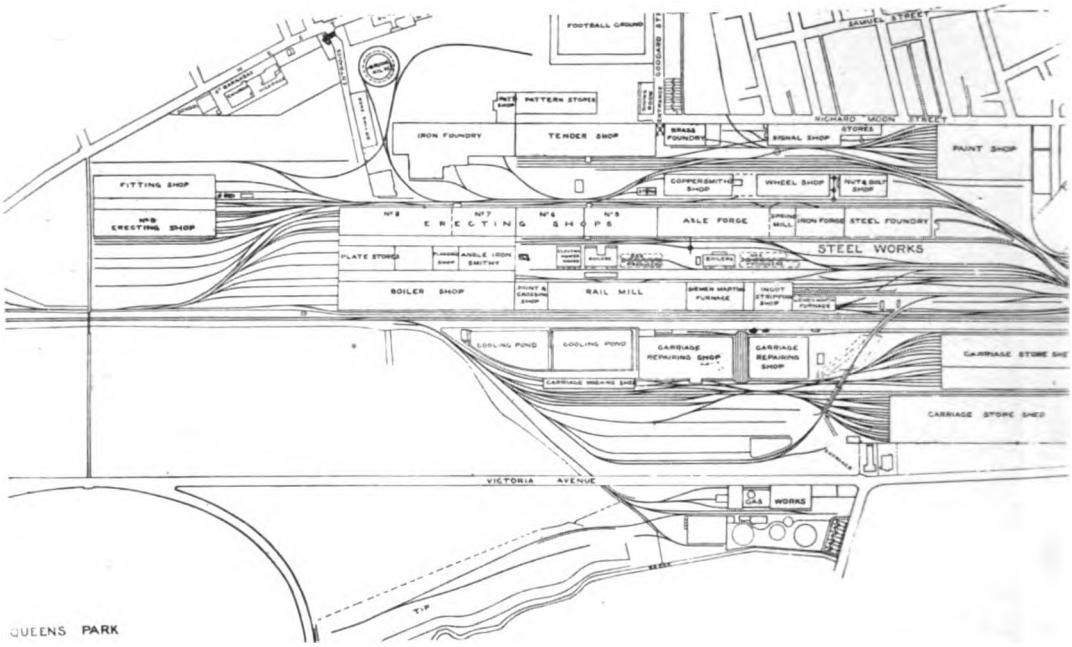

PLAN OF CREWE WORKS :

land thus acquired was purchased, together with further plots, for the growing town.

The works, with most of the town, stand in the parish of Coppenhall, but as there was once a station at Coppenhall, the name of Crewe was adopted out of compliment to the Earl of Crewe, whose seat, Crewe Hall, is in the neighbourhood. One may ask "What's in a name ?" but the euphony and simplicity of the title selected has had, at least, something to do with the world-wide familiarity which is now associated with the name of Crewe, even apart from its actual importance as a railway centre and as the site of the celebrated railway works. The station was opened in 1837, the triple junction being completed in 1842, though the Manchester and Birmingham Railway at first had a separate station, the connecting single line being used only for through coaches and transfer vehicles. A plan of the station, published in the RAILWAY MAGAZINE (September, 1899), is now reproduced, as being of general interest. It was drawn from memory by Mr. W. E. Winby, son of Captain Winby, the first stationmaster.

In 1843 the Grand Junction Company removed their works from Edgehill, Liverpool, to Crewe. Ground was also acquired for workmen's cottages, at that date 161 men being employed. Three years afterwards there were 600, and the population of the town had then grown to about 2,000. Ten years later these figures were quadrupled; but at the present time the works alone cover about 137 acres, 48 of which are covered, and over 7,000 men are employed. Several thousand more are attached to the station, traffic department and other sections of railway activity, while the population of the town is now about 40,000. The works extend for nearly 2 miles, the old section being placed in the angle between the Liverpool and Chester lines, while the newer portions follow the latter route nearly as far as Worleston, the first station beyond. Over 1,000 workmen's cottages belong to the Company, and, as showing the close association between the railway and the town of Crewe, it may be mentioned that the London and North Western Railway supplies gas and water, not only to their own premises, but to the whole place. The gas works are located on the south side of the Chester line, about half a mile from the station, while the waterworks are at Whitmore, 12 miles south of Crewe.

It is somewhat difficult to define the limits of the Chief Mechanical Engineer's Department. In addition to the construction of new locomotives and the maintenance and repair of the 3,000 or so engines in service. Mr. C. J. Bowen Cooke, the Locomotive Engineer, has control of the

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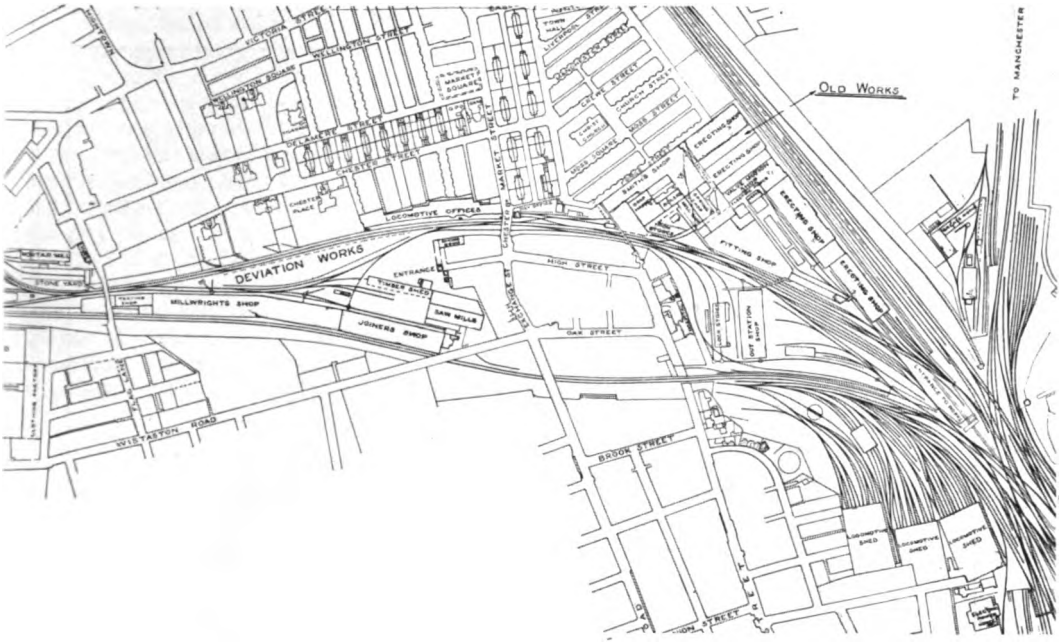

LONDON AND NORTH WESTERN RAILWAY.

locomotive staff all over the system when working trains, as also as at the various depôts. He is not concerned in the construction and repair of carriages and wagons, these departments being more or less distinct, and located respectively at Wolverton (under Mr. H. D. Earl), and Earlstown (under Mr. A. R. Trevithick). For these divisions certain work is, however, done at Crewe; and in addition Mr. Bowen Cooke has charge of the steel works, rail-making plant, and signal works. He is likewise responsible for a large variety of construction work for the engineers', steamship, signal and other departments. Indeed, one may say that everything is done at Crewe which is not covered by the carriage and wagon works and a few other small departments about the system. Originally carriage and wagon work was also undertaken at Crewe, but the latter department removed to Earlstown in 1853, and the former to Saltley, Birmingham, in 1859, while a few years later the carriage department was centred at Wolverton, the locomotive department previously located there being transferred to Crewe.

In early days the Company supplied not only cottages, water and gas, but were also concerned in the provision of schools, doctors and baths. For a time church services were held in the works by a clergyman paid by the Directors. A sum of £1,000 was voted for the erection of a church, but this amount proving insufficient, part of the sum required was made up from a very appropriate source. Some of the shareholders declined to accept the portion of their dividends earned by Sunday working, and about £500 standing to their cerdit in the books was handed over to the church fund, together with £391, balance of the Directors fees which remained unpaid in February, 1843. Having thus provided for the physical, moral, and religious wants of their people, the directors next endeavoured to meet their intellectual requirements. Accordingly an institute was built, containing a library and reading-rooms. Classes were established for instruction in various branches of practical knowledge, and from this institution it is said that more Whitworth scholarships have been gained than from any other of a similar kind in the country.

A somewhat original arrangement was adopted for the government of the new settlement. Twenty names were submitted to the Directors, who selected 12, of whom nine were to be elected. To these the Directors added three. For public purposes the district was under the jurisdiction of the Nantwich Rural Sanitary Authority and the Nantwich Highway Board. In 1860 it was felt that the town had grown sufficiently to be able to govern itself, and in that year the

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Photo] [*H. Bullock*.

MR. C. J. BOWEN COOKE.

Chief Mechanical Engineer,
London and North Western Railway.

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Crewe Local Board was formed. This was not an extravagant body. The Clerk, Surveyor, and Treasurer received between them £35 per annum. An effort was made to secure a sanitary inspector for £8 per annum, but the police sergeant was firm, as became a man in his position, and rather than lose his services the Board sadly rose to another £2, increasing the pay to the munificent sum of £10 per annum! But the Board did good work in its day, and when, in 1877, the town arrived at the dignity deserving of incorporation, with Mayor, Aldermen, and Town Councillors, its condition was such as to do no discredit to the body by which it had been governed for 18 years. Dr. Atkinson was elected first Mayor on July 9, 1877.

The loyalty of the people was evinced by the splendid Volunteer (Railway) Engineer Corps, 600 strong, a body of men whose training, skill, and fine physique entitled them to a place amongst the most effective of our citizen soldiers. With the exception of the Commanding Officer and second in command—both retired "regulars"—all the officers and men were in the service of the London and North Western Railway Company, and during the South African War 6 officers and 280 men went to the front to assist in repairing and working the railways at the scene of operations. The work done by these men was admitted by the highest military authorities to have been of the greatest value, and yet, in face of this acknowledgment, the War Office, for some reason beyond the wit of ordinary mortals to understand, in March, 1912, issued an order for the disbandment of the Corps, by which ill-advised action the services of a body of trained railway engineers has, as far as regards war purposes, been lost to the country. There is also connected with the works a well-organised Fire Brigade, the residence of each member being in electrical communication with one of the offices, so that in case of an alarm of fire no time is lost in calling them out.

MR. W. W. H. WARNEFORD,
Works Manager.

MR. J. N. JACKSON,
Chief Draughtsman.

The first Locomotive Superintendent, Mr. F. Trevithick, was the son of the man who first showed the possibilities of the locomotive engine, and himself produced engines which in their day were considered models of the most perfect type of locomotive. Mr. Trevithick was succeeded by Mr. Ramsbottom, by whom were introduced several changes, which had a most important bearing on the progress of the town. The first steel rails were rolled at Crewe in 1861, and

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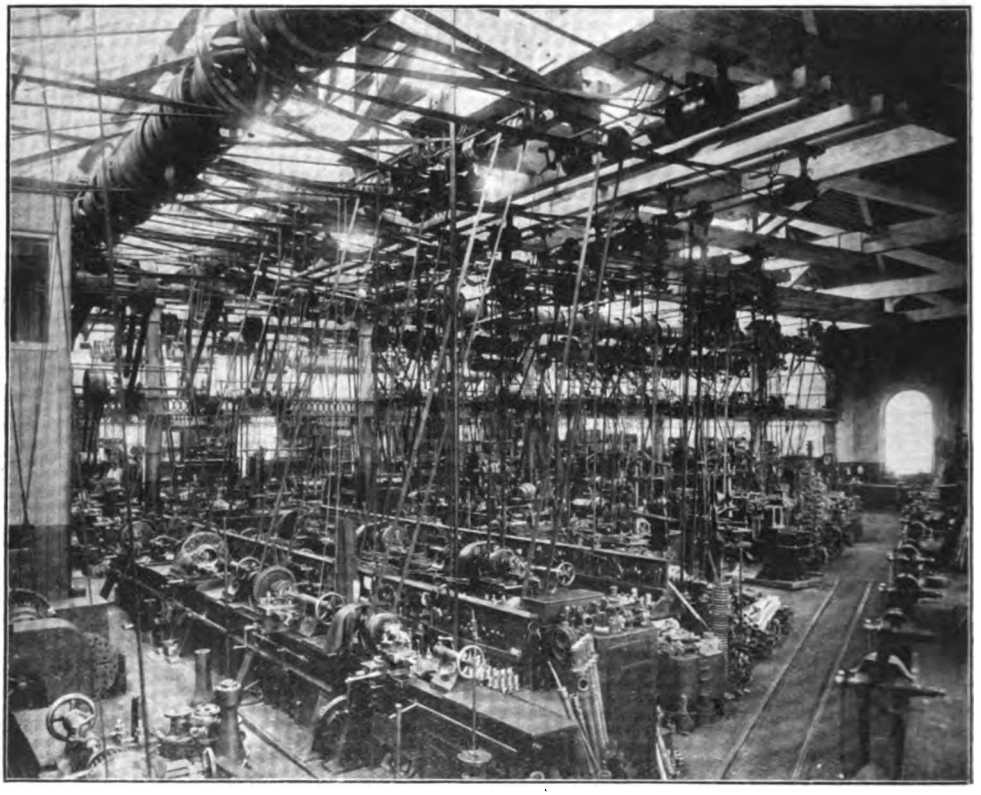
exhibited at the great Exhibition in 1862; the first locomotive boiler made of Bessemer steel was built at Crewe in 1863; in 1864 the Bessemer steel works were erected, and in consequence a large number of additional workmen employed. In 1868 Siemens-Martin furnaces for the conversion of steel were constructed. Crewe was the first place to take up the making of steel on a manufacturing scale, both by the Bessemer and the Siemens-Martin processes. So fully was the encouragement given to the invention by the management at Crewe recognised by those most interested, that when the freedom of the City of London was presented to Sir Henry Bessemer in 1882, the gold casket in which it was enclosed had on the cover a vignette in *repoussé* work of a London and North Western locomotive, entirely constructed of steel and standing on steel rails.

Mr. F. W. Webb, who succeeded Mr. Ramsbottom on his retirement from the service of the Company in 1871, increased the use of steel to such an extent that it has virtually superseded iron for every purpose to which it can be applied. In 1874 the Company began to make their own signals on a system devised by Mr. Webb, and this step led to another large accession of workpeople. The making of other articles has been introduced from time to time, until the works have become, as already indicated, a great assemblage of workshops for the manufacture of almost every article required on a railway.

In connection with the Queen Victoria Jubilee festivities in 1887, celebrating also the completion of the 50th year of existence of the Grand Junction Railway and the construction of the 3,000th locomotive at Crewe, the Queen's Park was presented to the town by the Company. It may be added that Mr. F. W. Webb was Chief Mechanical Engineer from 1871 until his retirement in 1902. From November, 1886, until November, 1888, he was Mayor of Crewe. He was succeeded in 1903 as Chief Mechanical Engineer by Mr. George Whale, who retired in 1909, his place being taken by Mr. C. J. Bowen Cooke, the present occupant of the



A VIEW IN THE FITTING SHOP: OLD WORKS.

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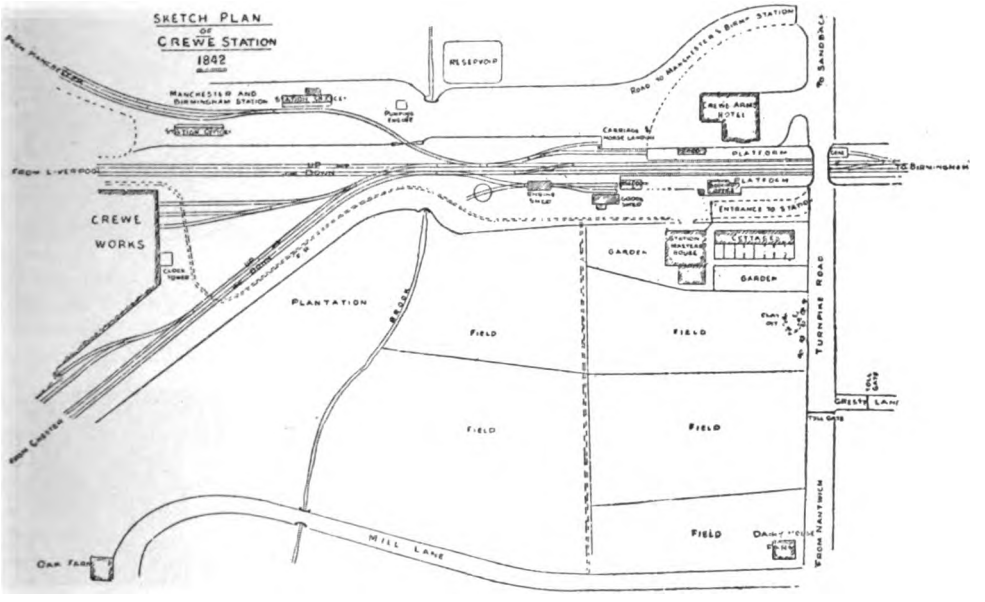
office. Neither Mr. Webb and Mr. Whale lived long to enjoy their well-earned leisure, but the memory of the former will for ever remain in association with the Webb Orphanage, which was opened last year, as also with certain scholarships available for students of the Mechanics Institute; while the latter will not be forgotten until the work of his "Precursors" and "Experiments" and other engines is entirely overshadowed by that of their developments and successors for which Mr. Cooke has been, and we hope will for many years continue to be, responsible.

The works now consist of three main sections—the "Old Works," near the station; the "Deviation Works," close to the Administration Building; and the "Steel Works," the newer section along the Chester line, where, however, the steel-making plant is only one feature in a comprehensive series of workshops amplifying the "Old" and "Deviation" premises. The Administration Building, one of the most remarkable structures of its kind, consists of a huge block fronting the main line of railway through the works. It is on a slight curve, and its walls are almost covered with ivy, while trees and plants in front combine to give it a very picturesque character. One of the accompanying illustrations gives a suggestion of the effect there realised. Unfortunately, however, this view is "strictly private," the public entrance alongside the Chester Bridge carrying Market Street over the line being commonplace in character. In this building are numerous offices devoted to the various divisions of work, with the drawing office, photograph department, and laboratory, accommodating about 400 clerks, draughtsmen and others. Adjacent to this building are the residences of the Chief Mechanical Engineer, Works Manager, and other chief officers of the department.

Starting from the Administration Building the "Old Works" may first be visited. On the way, at the foot of Chester Bridge, is a small building, one division of which accommodates a steam fire engine on a specially constructed railway wagon, while the other houses Mr. Cooke's private saloon, to which is now attached the famous 8 ft. 6 in. single-wheeler No. 3020 *Cornwall*. Further along is the pay office. We then enter the Smithy, passing a 10-table Pooley weighing machine and a vacuum brake testing frame, *viâ* the Drop Hammer Shop. The vacuum testing frame referred to is so constructed that an equivalent to the brake equipment of a complete train can be applied to each engine, supplying what is virtually a running brake test before the engines are sent out.



SKETCH PLAN OF CREWE STATION, SHOWING PART OF THE WORKS, AS IN 1842.

Crewe is noted for its drop forging plant. Here this method of manufacture has been raised to the level of a fine art, and hundreds of parts of all sizes and classes are in this way forged. By this method forgings are

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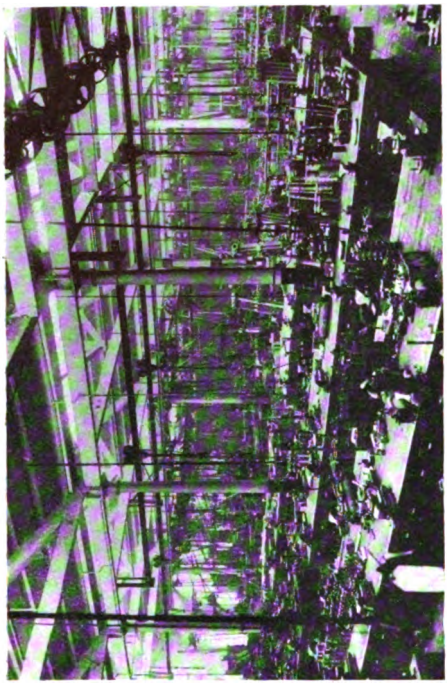
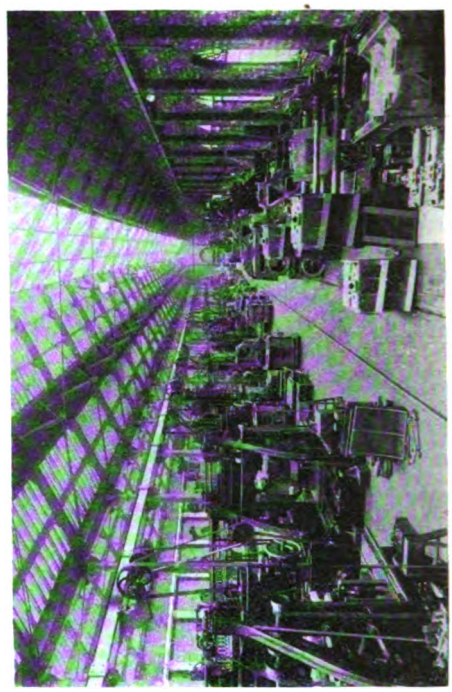
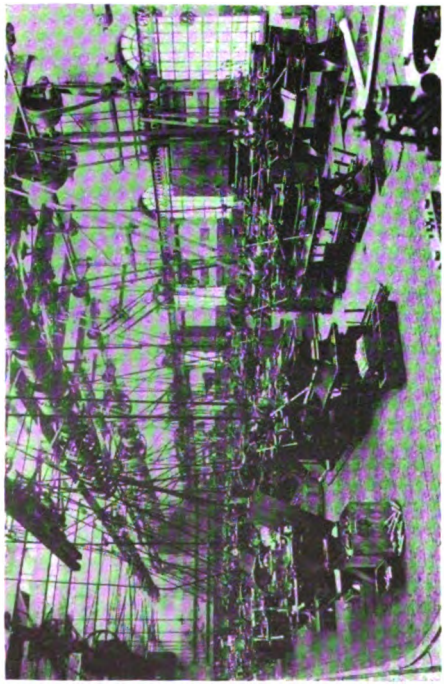


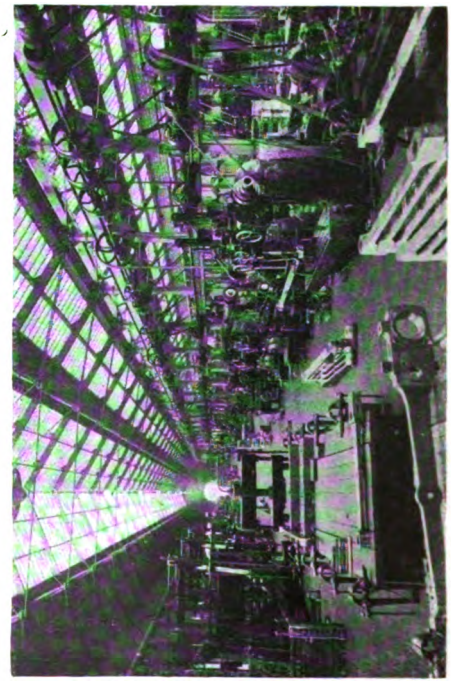
FITTING BENCHES: OLD WORKS.



NEW FITTING SHOP: STEEL WORKS END.



GROUP OF CAPSTAN LATHES: OLD WORKS.



NEW FITTING SHOP: STEEL WORKS END. ROD SECTION.

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produced quicker, cheaper and more accurately than is possible by the ordinary process of hand forging. There are 14 drop hammers, the weights of the same varying from 8 cwt. to 30 cwt. Steam turbines are used for lifting, but the blow is given by gravity, the rope connection supplying a resilience and freedom lacking in forging presses as used for heavier work. In this division there are also for rough forging three steam hammers, varying from 7 to 50 cwts. Adjoining is the smithy, where 8 steam hammers (7-15 cwts.) are erected. In this division and in the forge are 90 smiths' hearths. The Thompson electric welding plant is in constant use for welding tie rods, injector rods, hand railing and other metallic parts, while Roots' blowers are used to supply blast to the smiths' hearths. A series of locomotive type boilers provide steam for the drop hammers, and several Galloway-Cornish boilers serve the steam hammers, as also a Wilson gas producer outside for the gas furnaces. A coke breaker is installed for breaking up coke into suitable pieces for the smiths' hearths. Part of this section is given over to a tool-hardening bench, where milling and other cutters, drills, taps, roller tools are hardened either in a Brayshaw high-speed hardening furnace or in an American gas furnace adapted for hardening carbon steel.

In a shop adjoining dies for the drop stamps are made, and the tools provided include planing, shaping, slotting, drilling and grinding machines. The spring shop has three gas furnaces for hardening and tempering, oil or water baths are used according to material and requirements. Various hydraulic machines are at hand for bending plate springs, making coil springs, removing buckles from springs (the buckles are applied by hand and shrunk on to each nest of springs), and for knibbing, punching and other operations. Every spring, before being sent out, is tested in a special machine giving test loads of from 12 tons to 15 tons, and is not passed unless it withstands the test load without causing more than the legitimate deflection. Two special sets of pumps and accumulators supply hydraulic pressure at 1,800 lbs. per sq. in. to the shop. Outside this group of buildings is a large iron store for rolled sections. A case-hardening department for pins and motion work is included in this series of shops.

Beyond an entrance passage the visitor comes to Nos. 3 and 4 erecting shops, now reserved for smaller engines, such as the ordinary goods and tank engines, the crane power available not permitting of large modern locomotives being lifted. No. 4 shop is designed upon the double-bay three-road principle, the centre line of each set of three being used for vehicles and for moving parts from place to place. There are four overhead 25-ton electric cranes—two in each bay. Fitting benches line the walls, while a few tools are located between the central pillars. A complete equipment of flexible drilling and portable rivetting machines is included, and among special apparatus may be mentioned electric cylinder boring and valve facing machines for boring cylinders and facing valve seats in position, and a Webb electric tube-cutter. The latter consists of a small eccentrically mounted circular saw, which can be passed through the end of a boiler tube in the tube plate, and driven electrically through its spindle so as to cut off the end of a tube inside the tube plate, thus avoiding the necessity for removing the latter.

One bay of No. 3 shop is equipped and used in the same way as No. 4 erecting shop, but the other bay is now utilised for miscellaneous machinery and other purposes. There are two wheel lathes for turning tyres, and boring, punching, grinding and other machines. A 5-ton elec ric mono-rail walking crane is also here installed. One division forms a store for the millwright's department (repair and maintenance of machinery), while another accommodates special tools which may be required in the adjacent shops, oil and waste supplies. The valve motion shop alongside is used for miscellaneous purposes. One division forms the motion shop, where repairs to stationary and other plant are undertaken. Here may be seen double lapping-out machines, for accurately grinding holes for link pins; lathes, drills, boring machines; hydraulic presses for forcing hardened steel bushes into coupling, connecting and valve rods, for inserting brass steps in steel axle boxes, and for forcing crank pins into wheels; and other tools. A machine for grinding slide bars may also be noticed at work. In this division coupling rods are bored and fitted up, and wheels assembled and equipped. At the end is a gauge testing bench, where gauges of all classes are tested against standard gauges. Pyrometers for superheater engines are here refilled with ether and then examined. Two electric walking cranes, each of 4 tons capacity, provide crane power to this shop.

At one end of this building is a small shop devoted to repairs to brake gear. This constitutes virtually an annexe to the Fitting

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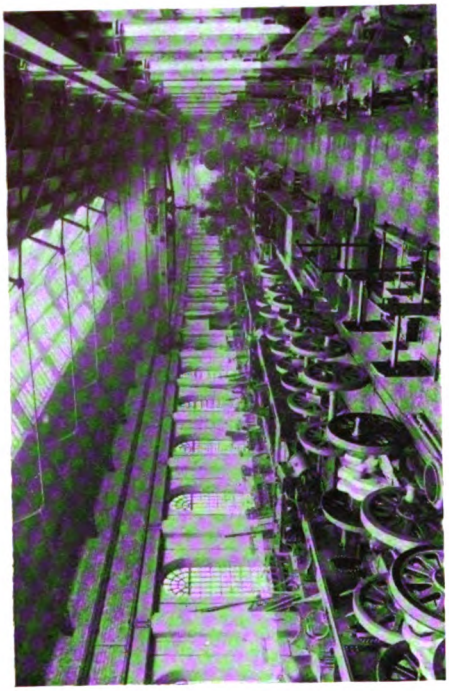
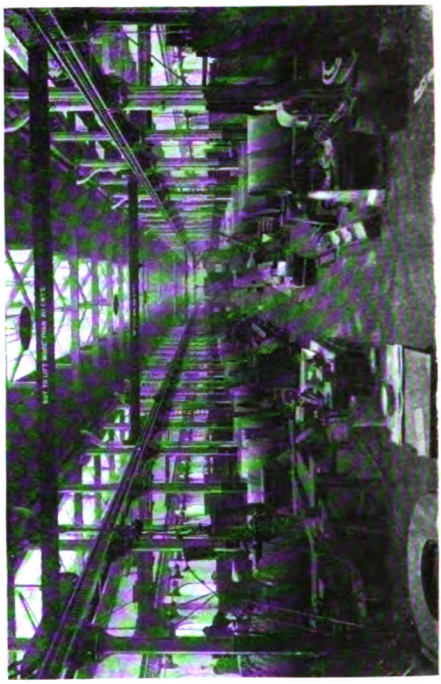
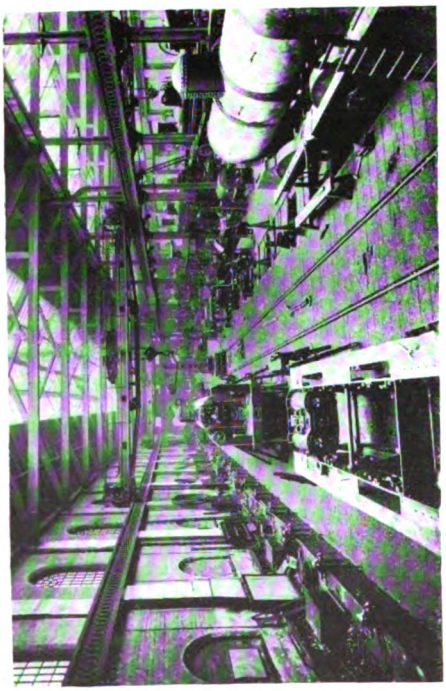


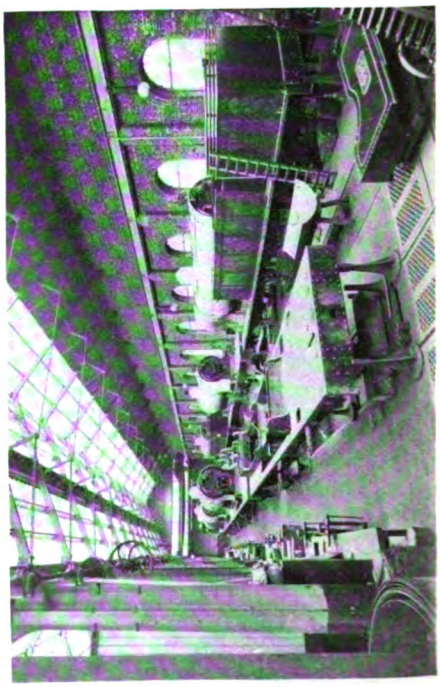
NO. 8 ERECTING SHOP: STEEL WORKS END.



BOILER SHOP: STEEL WORKS END.



NO. 3 ERECTING SHOP: OLD WORKS.



PART OF NO. 9 ERECTING SHOP: STEEL WORKS END.

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Shop—the principal department of the "Old Works." There are in reality two "Fitting Shops," each meriting the more correct description of "Machine and Fitting Shop," seeing that both contain a remarkable collection of machinery and machine tools, in addition to fitting and assembling benches. For the present I am, however, concerned only with the Fitting Shop in the Old Works. This is an enormous structure, approximately triangular in shape, containing upwards of 360 different machines. Here pistons, valves, motion, slide bars, connecting rods, injectors, boiler fittings and other details for locomotive engines are machined. As will be gathered from appended views, this shop presents a busy and complex appearance, owing to the maze of overhead shafting and belting; but actually, as one passes from section to section, its orderliness and relative simplicity is soon appreciated. A few of the large machines are driven by independent electric motors, but the usual practice is to operate the machinery in groups by electric motors, thus utilising the shafting and belting installed when steam engines were relied upon. This sub-division of plant, while it entails the retention of shafting and belting, is also advantageous in other ways.

Beginning at the southern end, we first enter the ground floor of the stores building adjoining. This section forms an extension of the fitting shop proper. A series of planers, drills, milling machines for cutting grooves in valve faces, vertical millers and other tools may first be examined. There are also six double-headed brass working "Universal" machines built at Crewe. These are adapted for machining brass fittings, cocks, and other devices of a more complex character than can be dealt with in ordinary machines at one operation. For example, a T-fitting can in one of these be machined throughout, a selection of cutters, dies and other tools being brought into use in order, while the tool holder is turned from one position to another, so that each section of the fitting is treated by the respective tools without removal from, or re-adjustment on, the machine. A large selection of cutters, tools and work-holders, with a system of stops and adjusting devices, enables these machines to be used for many purposes, and each covers work which would otherwise require a series of distinct operations in different machines.

Beyond are various tools for ordinary brass work, consisting of lathes, shapers, planers, slotters, and drills, and then, passing a hydraulic lift connecting with the upper floors which constitute the stores building for this department, we enter the main fitting shop. Several fairly large machines first call for attention. Among these may be mentioned a high-speed planer by the Bateman Machine Tool Co., a machine constructed by the Churchill Machine Tool Co. for grinding and trueing valve rods, in which the work moves; a somewhat similar machine for grinding and trueing piston rods (the tool moves in this) by Messrs. Richards & Co.; together with a series of lathes along the wall, a boring mill, and several vertical milling machines. An automatic machine for making standard handles by Alfred Herbert and several automatic machines for light brass work are placed beyond; but most of the work admitting of automatic or semi-automatic machining is done with the aid of semi-automatic and capstan lathes. Many of these machines are by Alfred Herbert. One is used for screwing stays for Belpaire fireboxes. A composite vertical machine for machining injector bodies may also be seen.

A series of fitting benches for brass, motion, valve gear, piston valves and other details, where necessary hand work, assembling and other operations are conducted, next call for attention. Continuing along the east side are a semi-automatic machine for making gudgeon pins, several small capstan lathes, a "copying" machine for making name and number plates, and a double-headed Webster & Bennett vertical boring machine and other tools. In the corner is a safety valve testing and repairing shop, and here a boiler is provided so that all safety valves may be tested to their working pressure under steam, a reducing valve allowing of variation as required for different engines. Adjacent is a tool-shop, where cutters, drills, and taps are machined, while miscellaneous operations are carried on, including the manufacture of joints for wooden legs and arms, and ball bearings for motor vehicles. Next is the steel tool shop, containing special machines (by W. Muir & Co.) and other makers and including some American tools) where hardened steel milling cutters and grinders are made.

Then there is an enclosed division where standard gauges, templates, and parts are kept under the strict control of the responsible assistant in charge. In one series of cases are carefully and accurately made standards, issued as required to the mechanics

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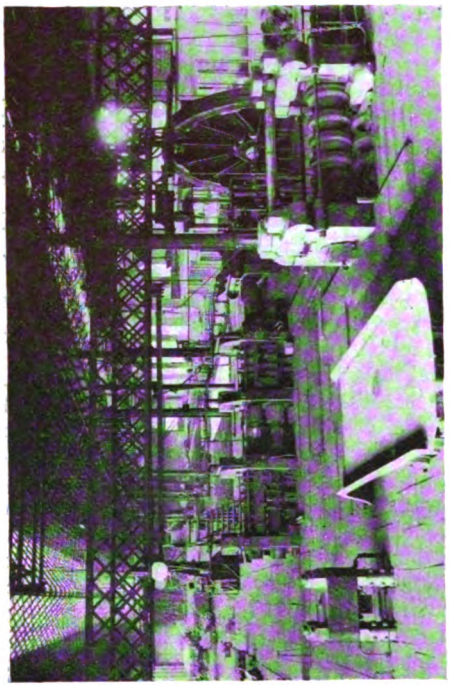
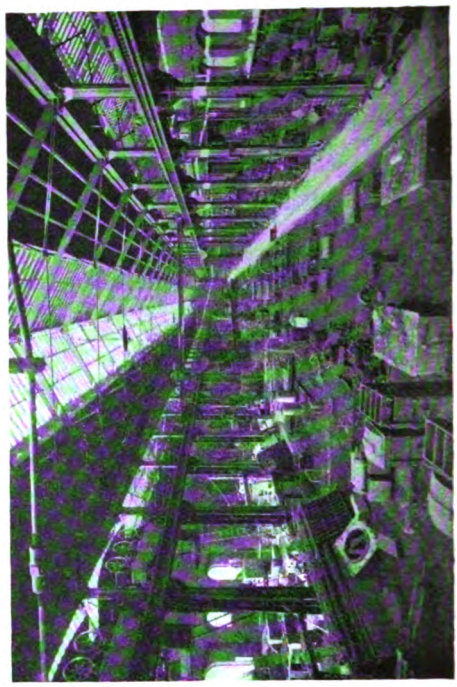
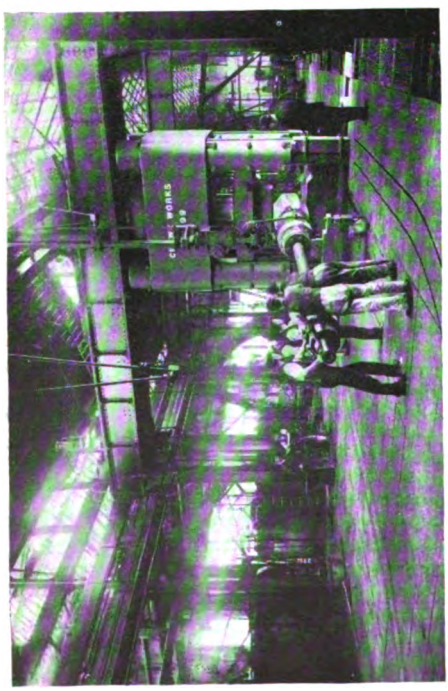


RAIL MILL: STEEL WORKS.



IRON FOUNDRY.



HYDRAULIC FORGING PRESS: STEEL WORKS.

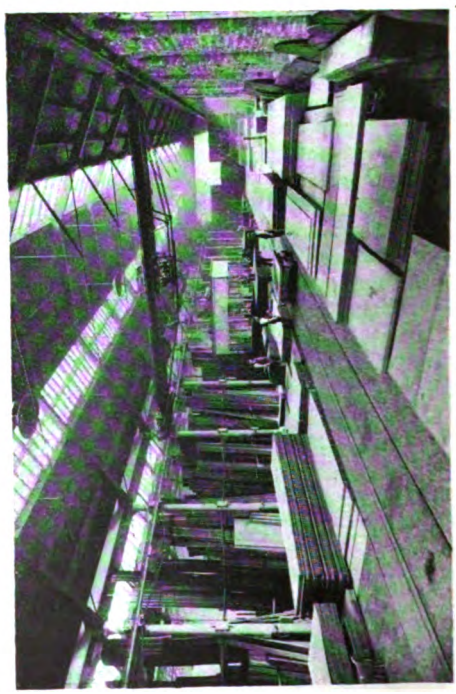


PLATE STORE: STEEL WORKS (SHOWING LIFTING MAGNETS IN USE).

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in charge of various machines. The same have to be signed for and returned in good order, or the cause of any damage explained. Another set of cases contains "master" standards, which never go out unless it be necessary to make a new working standard therefrom, for which purpose, of course, only the most trustworthy workmen are employed. These "master" standards are machined so accurately that if a rod be passed through a corresponding opening, it will, if no stop be made, go through perfectly; but if only a part be passed through, the fit is so exact that the rod cannot be moved further, owing to skin friction, unless it be tapped lightly with a hammer.

The remaining space in the fitting shop is used mainly for larger machines and miscellaneous tools. Among them are several four-spindle lathes, on which four reversing screws can be cut simultaneously, or other work done in multiple; slot drilling machines for making cottar holes; universal lapping machines for accurately grinding out holes for pins in motion work; a Muir machine for milling valve gear members; groups of slotters, planers, and drills; a Craven radial arm drill; two Asquith high speed radial drills; a radial planer for quadrant bars as used for engine reversing levers; a large Crewe-built radial miller for machining quadrant slides of valve gear; several other milling machines of various kinds; a centreing machine; and a series of general screwing machines. At the end are several marking off tables. Adjoining is a grinding and glazing shop where slide bars and rods are finished. Between the fitting shop and No. 2 erecting shop, adjacent to the axle box shop, is the electric power station for this section of the works. Five high speed Belliss & Morcom engines are supplied from a battery of Galloway-Cornish boilers fitted with Erith stokers. Each engine is directly coupled to a Lancashire Dynamo & Power Co.'s dynamo. To increase the boiler plant, a Babcock & Wilcox boiler is being erected.

No. 2 erecting shop is used chiefly for 0–6–0 goods engines, the head room being insufficient for more modern engines. There are two bays, each with three roads, and between the same is a central arcade where a few tools are erected. About midway along an electric traverser is placed transversely, and outside is a plant for "poshing" motion parts of engines in for repair. Here to remove oil, grease and dirt, they are immersed in a bath of caustic potash. Adjacent is a small shop for general coppersmiths' work and metalling axle boxes, together with a tube shop with high-speed saw and rumbler. No. 1 erecting shop, with the old gateway and clock tower, is notable in that it was one of the first buildings erected when the works were established at Crewe in 1843; but its glory has long since departed. It is still an erecting shop, accommodating at one end about six of the smaller engines; but most of its space is now utilised as a boiler mounting shop, for repairs to boilers, and for various purposes.

The stores building adjoining the fitting shop, and No. 1 erecting shop may next be considered. As already stated, the ground floor constitutes part of the fitting shop. Above is a general store for rough brass work for the fitting shop, while the top floor accommodates small iron stores, bolts, nuts, rivets, piston rings, and ferrules. A system of charts is in use covering not only the standard sizes of all details, but also the variations caused as cylinders are bored out, valves faced, and other repairs undertaken, so that it is only necessary to specify the reference to enable the desired article to be supplied, either to the works or to out-station repair depôts.

On the south side of the main line of the works railway system are several buildings, including an oil gas works, tinsmith's shop (where station, train, signal and other lamps, oil cans, and many miscellaneous items are made), and stores for gas and various other fittings. Adjacent thereto is the main oil stores, equipped with tanks and mixers. Two boilers supply steam for heating coils in the tank and running the pumps. A washing and wringing plant is installed alongside. Here waste cloths are cleansed. The equipment includes "dolly" washing machines, wringers, and hydro-extractors, the Summerscale process being used. Outside is a series of drying sheds arranged in divisions, the cloths received from each depot being kept separate, so that they may be returned to the department from which they have been received. The grease extracted, with that from the various "poshing" baths distributed about the works, is utilised for making soap.

Erected in 1906, the general store is a fine building. Its lower floors receive supplies of all kinds, but the top storey is perhaps the most interesting division for here are the sample rooms. Laid out upon tables, hung on pegs along the walls, placed on shelves or otherwise disposed of, is a

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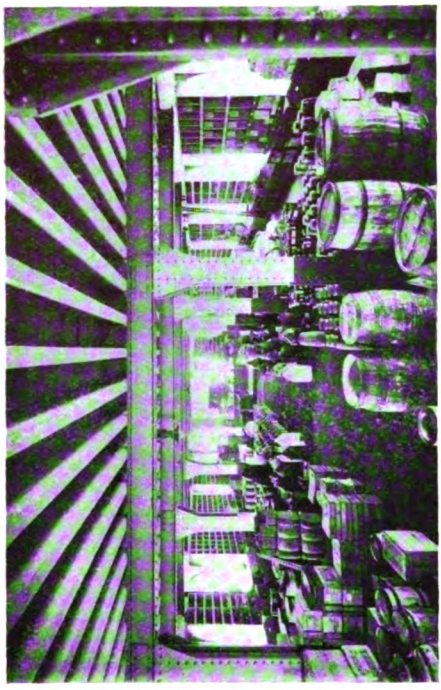
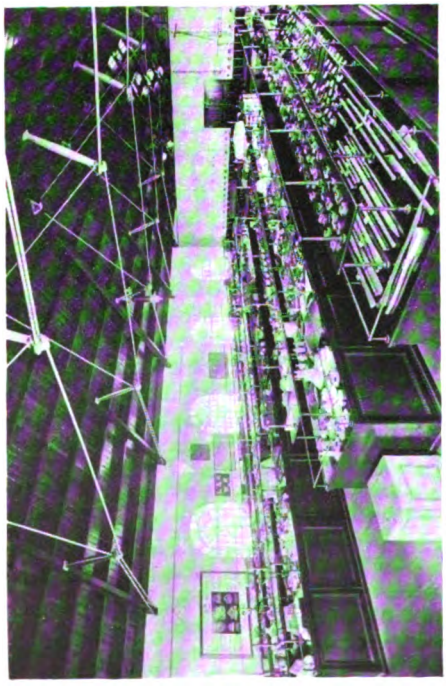
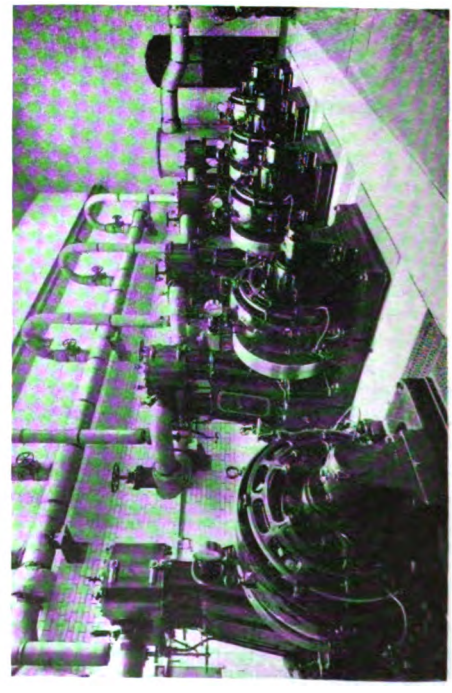


IN THE STORES BUILDING.

SET OF DROP-HAMMERS.



PATTERN ROOM IN THE STORES BUILDING.



POWER STATION: OLD WORKS.

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wonderful collection of articles, all under seal, representing the standards to which outside firms and contractors must conform in supplying goods to the company. The specimens range from gas tubing, upholstery, clothing materials, glass shades, paints and varnishes to shovels for enginemen, permanent way gangs, and others, with thousands of other articles of large, small and medium size. Representatives of firms desiring to tender are here allowed to examine the standards to which they have to conform, but none of the specimens is allowed to be removed or cut, except in certain cases, such, for instance, as fabrics and leather, in which cases provision is made for small clippings to be supplied. Near this building is the works hospital, where the minor accidents almost inevitable in such a vast establishment, receive attention.

Starting again from the Administration Building, the Deviation Works may now be visited. Here most of the work done is of a miscellaneous character, applying to the signal, general machinery and other divisions. Passing the workmen's dining hall, a small shed which accommodates a hand and horse-drawn fire engine may be noticed, alongside a check office for the entrance to this section of the works, and above is an apartment for the accommodation of the fireman on duty. Near by are large stacks of timber in various conditions, and then come the saw mills. The upper floor is a drying shed, and below is a varied selection of machinery, supplied mostly by Messrs. T. Robinson & Sons, of Rochdale. One machine is devoted to making keys for securing rails in chairs. A band saw for cutting brake blocks, a long-table self-feeding saw, two large multiple log saws, circular and band saws are also available. The end division is devoted to the making of signal posts. A cross-cut saw outside serves for cutting to length, and a long-table circular saw is available for longitudinal cutting. A special machine includes in one combination chamfering and tenoning devices, and a rotary high-speed planer operrting on both sides of the posts. The table of this machine is about 100 ft. long. A gantry and overhead crane are erected in the adjacent log yard.

Adjoining is the electric power house for this section of the works. Here are three Babcock & Wilcox boilers, fitted with mechanical stokers. Next is the engine room containing six Bellis & Morcom (five of 125 h.p. and one of 100 h.p.) high-speed engines, driving direct-coupled Lancashire dynamos. A battery room adjoins, and in the basement is an arrangement for feeding refuse from the saw-mill to the boilers. Incidentally it may be mentioned that the motors for the larger machines in the saw mill are here located driving upwards by belting. The joiners' shop contains machines for grooving, dovetailing, making oak ferrules as used for bolts securing chairs to sleepers, morticing and drilling, planing, saw-sharpening, and copying lathes (by A. Ransome & Co., of Newark and London). On the top floor, in a gallery, one section is devoted to the woodwork of artificial limbs, the remaining space serving for general joinery. Beyond the division wall, locks and bolts are dealt with, the rest of the shop serving for electric work, including motor repairs, with a few lathes, drills, punches, armature - winding and other machines.

Descending again to the ground floor the visitor comes to a shop devoted to woodworking in connection with signals, gates, platelayers and fog signalmen's huts, machines being provided for drilling, sawing, grooving, slotting, trenching and other operations. A Greenwood & Batley "universal" moulding machine is included in the equipment. In the basement is a shop devoted to leather work, including saddlery, and hose and belting treatment. The next building is the millwright's shop, dealing with the erection and repair of cranes, capstans, turntables, girder work for signals, upkeep and maintenance of motor road vehicles, steamship machinery, and other requirements. Among the machines installed, some of a heavy type, may be mentioned a big vertical boring mill, multiple boring machines, a large Craven planer, a very large duplex planer (Thwaite & Carbutt, for crank webs and built up cranks, usually planing ten at once on the table), a vertical slotting machine (also machining ten crank webs at the same time), boring, facing, axle, crank axle and other lathes, a long shafting lathe, radial arm drills, and other tools. There are four 10-ton electric travelling cranes and one 30-ton crane. The further end deals with lighter and miscellaneous work, and included in the equipment are file grinders, two electric file cutters (Dennison), hand file cutters, file hardening furnaces, oxy-acetylene brazing plants, smith's hearths, and various machinery and appliances.

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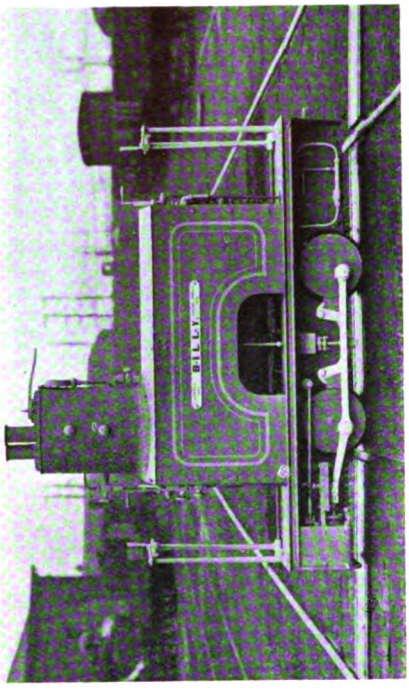
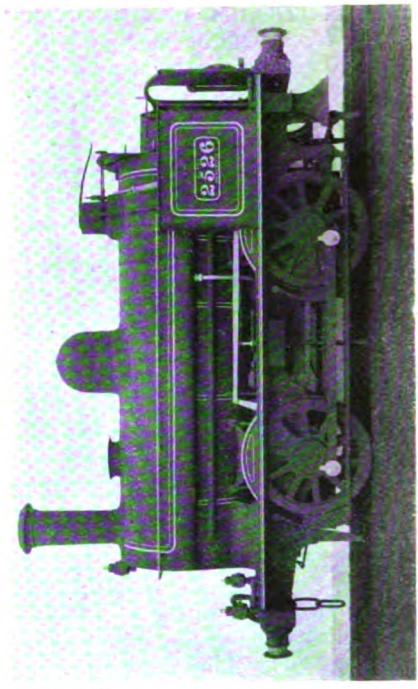
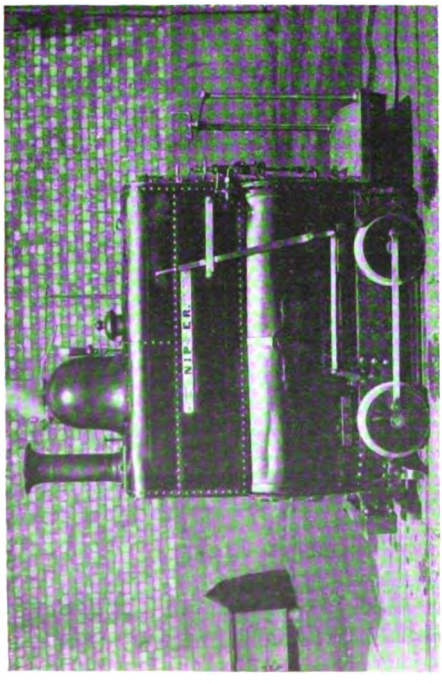


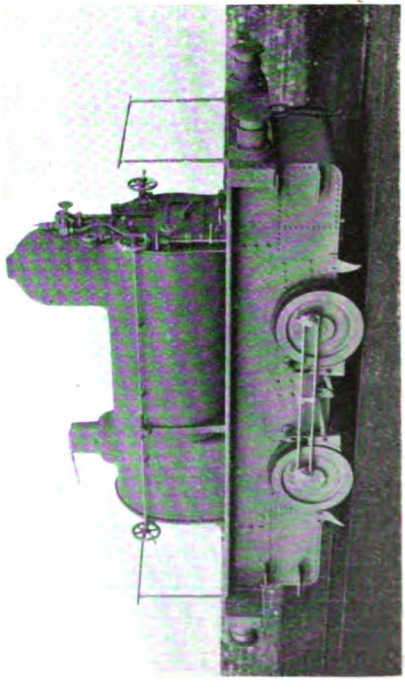
18 IN. GAUGE TRAMWAY ENGINE: CREWE WORKS.



STANDARD GAUGE SHUNTING ENGINE (4 FT. WHEELS): CREWE WORKS.



18 IN. GAUGE TRAMWAY ENGINE: CREWE WORKS.



STANDARD GAUGE SHUNTING ENGINE (2 FT. 6 IN. WHEELS): CREWE WORKS.

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Beyond is a chain-making shop with testing shop adjacent. The latter includes a 100-ton Tangye chain-testing machine, a Buckton rope tester, an older machine now used for testing cement, an oil tester and a Buckton facing lathe for preparing test pieces. Adjacent is the testing laboratory where sections of metal plates and bars are tested to destruction under tension, torsion, drifting out, crushing, bending and other strains. It may be added that pieces of almost every plate or bar used in the works are here tested before being accepted in the machine and other shops. At the end of this section is a chain-examining shop, where every link is scrutinised before being pressed for service.

The newer section of the works, west of the Administration Building, is generally known as the Steel Works, though its scope of operations extends much beyond the steel plant. On the way thereto may be noted the mortar mill, a large stone-yard and a cement store. The works railway system here divides, but for the present that section which is parallel to the railway to Chester may be followed. A large proportion of the area between the store yard and the steel-making works is used for storing rails, ladles and raw iron. Before reaching the steel-making plant, what is known as "Eagle Bridge," crossing the railway to Chester is observed. This name is due to the fact that each of the four corners is adorned by a large iron eagle with outspread wings. It is understood that many years ago they were included in a supply of scrap metal, but Mr. Webb, rightly considering that they might fittingly be used for ornamental purposes, placed them on this bridge.

Years ago the Bessemer converting plant was a conspicuous feature of Crewe Works, but the Siemens-Martin regenerative process is now used. Although the glamour of the Bessemer method, with its fiery and awe-inspiring effects, is not now associated with this section, the steel-melting furnaces still possess special interest. There are seven 25-ton and three 35-ton furnaces, together capable of producing 50,000 tons of steel per annum. To appreciate these furnaces properly one has to ascend to the upper floor, where they are fed, or watch the molten metal being poured into ladles, and thence into the ingot moulds carried on special railway trucks, running on rails below. Gas for the furnaces is provided by 58 Wilson gas producers, adjacent boilers supplying steam thereto. These producers also serve various reheating and other furnaces, a complete system of underground flues providing for distribution. Powerful hydraulic machinery is attached to each furnace for handling the ladles, with lifts for carrying iron to the upper floor in trolleys and for other purposes. Next to the melting plant is an apartment now utilised mainly for storing castings, but previously it was the Bessemer convertor house. Hydraulic accummulators, with the large pumping engines which supply them, are placed in this building; and adjoining is a small mill-wright's shop, where miscellaneous repairing work is done.

We then come to the rail rolling plant, one of the most attractive and important divisions of the works. Here are various reheating furnaces for the ingots, which are usually cast about 3 ft. 4 in. long and 14 in. square. These are passed five times through the cogging mill, which reduces their section to 10 in. by 8 in., with corresponding elongation. They are then run directly to the three-high rail mill, whence after 13 passes, they emerge as rails over 60 ft. long, weighing 90 lbs., 95 lbs. or 100 lbs. per yard. The cogging mill is driven by a pair of vertical reversing engines, and the rail mill by a Corliss engine of about 1,200 horse power. Driving rollers are used to assist in feeding the rails, though the men are very expert in passing bars to and fro. The rails are then fed past a transverse circular saw, and through straightening machines, after which they are ready for reception in store. In addition to the more modern rail mill, there is an older one for 30 ft. rails. At the end of this shop are a few tools for cutting rails, with drills, a hack saw, and a large Craven taper planer for tapering the ends of rails as required in assembling points and crossings. Next is a shop devoted specially to this section of the work. There are multiple tool planers, V-cutters, a V-slotter, a rail twisting machine, and various other planers, slotters, punches and drills. A steam engine is used for driving the machinery, while a separate engine works a large press for bending and straightening rails. A hydraulic pumping engine stands in one corner.

The boiler shop measures 673 ft. long and 107 ft. 6 in. wide, its capacity being more than sufficient for the large output of new and repaired boilers required at Crewe, in addition to a substantial percentage of stationary boiler, bridge, signal gantry, footbridge and similar work. A wall-engine

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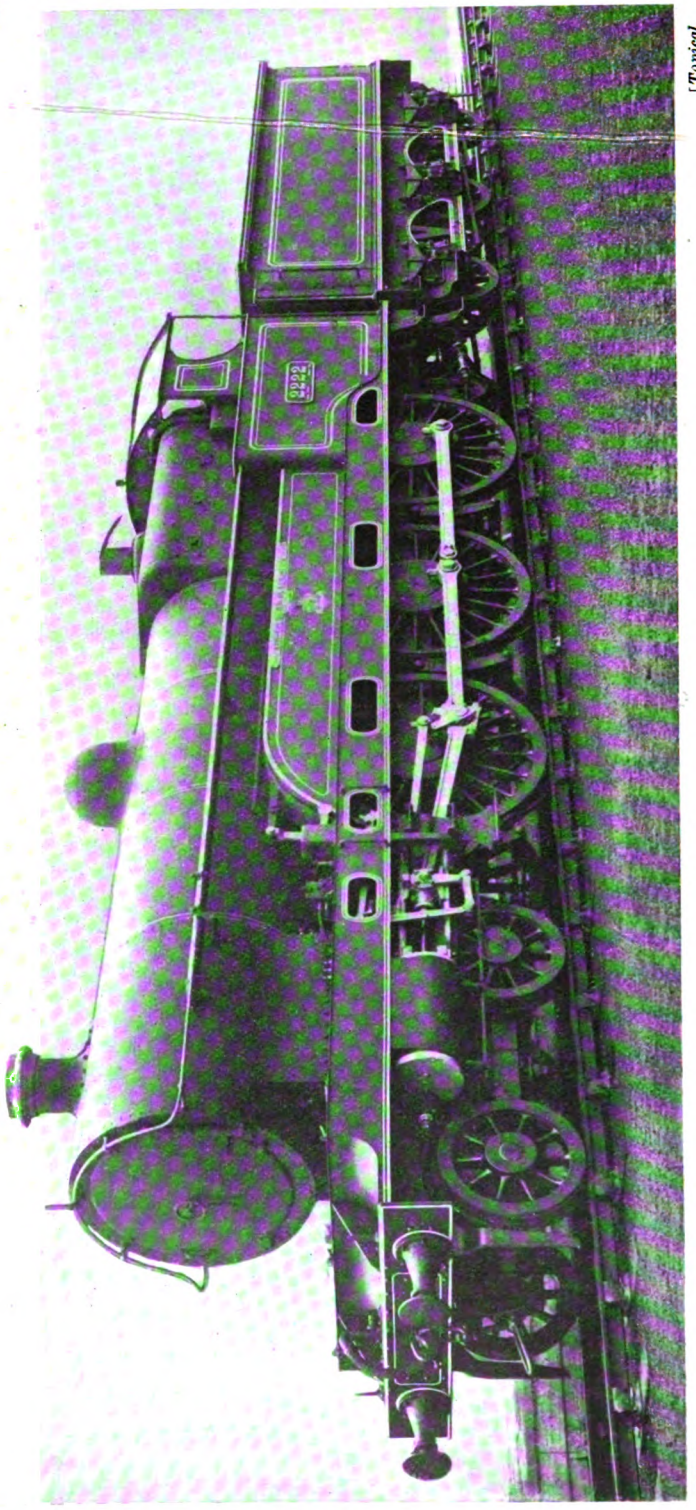

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NEW FOUR-CYLINDER NON-COMPOUND 4-6-0 LOCOMOTIVE (SCHMIDT SUPERHEATER). No. 2222. *Sir Gilbert Claughton.*

Designed by Mr. C. J. Bowen Cooke, Chief Mechanical Engineer.

Cylinders (4), 16 in. by 26 in.; Coupled Wheels, 6 ft. 9 in.; Bogie Wheels, 3 ft. 3 in.; Steam Pressure, 175 lbs. per sq. in.; Heating Surface — Tubes, 1,647·2 sq. ft., Firebox, 171·2 sq. ft., Superheater, 413·6 sq. ft., Total, 2,332 sq. ft.; Grate area, 30·5 sq. ft.; Adhesive Weight, 57 tons; Weight of Engine and Tender in Working Order, 116 tons.

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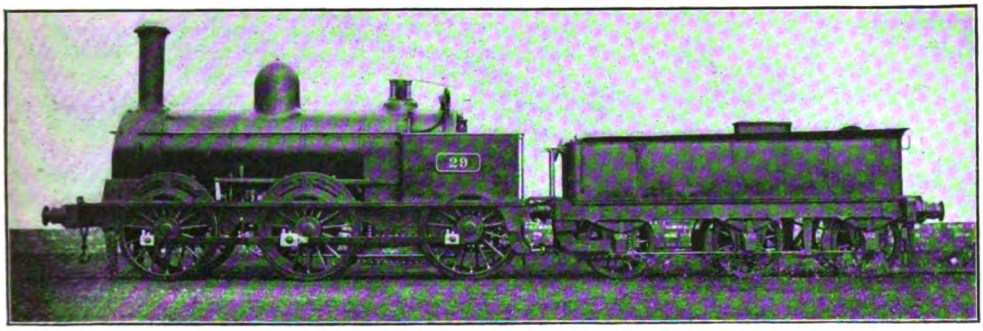
provides steam power, but hydraulic and pneumatic tools are largely employed. A portion of the shop, where the roof has been raised, is fitted with two 15-ton electric cranes, so that the longest boilers may be rivetted on end. There are also five other electric cranes, one of 20 tons, one of 15 tons and three of 10 tons capacity. The machinery includes radial arm drills, multiple drills, tools for milling foundation rings, plate and angle rolls, lathes, punching and flanging apparatus, planers for firebox door openings, diagonal drills for drilling fire-door openings, right angle drills for throat plates, right angle planers and edge planers.

Parallel with this building are the angle iron smithy, flanging shop and plate stores. The first of these accommodates a gas welding plant, three steam hammers (7 cwt., 15 cwt., and 30 cwt.), angle bending machines, 60 smiths' hearths and various tools required for making grate bars, foundation rings and angle iron work. In the flanging shop a number of large hydraulic presses are installed, the larger ones allowing of throat and tube plates being pressed out solid, while other presses serve for smaller work. Gas furnaces are adjacent. The further section of this shop is used for making iron fencing, hurdles, and general iron work. In the plate store beyond may be noted an electric-magnet, suspended from an overhead crane, for lifting and moving plates.

Returning to the east end of this section of the works, the steel foundry may be visited. Wilson gas producers, erected outside, supply gas to three Siemens regenerative furnaces, and overhead tramways enable the ladles as they are filled to be moved across the shop to the casting pits and moulds. Wheels of all sizes are here cast, and a variety of other work is undertaken. Overhead and jib cranes, revolving hydraulic tables for casting wheels, axle box moulding and other machines are installed. One side of this shop is almost entirely set apart for the dressers, a large number of whom are necessarily employed in dressing the castings, removing fins and superfluous metal, and in like operations. Outside this shop is a pit for breaking up ingot moulds and castings. The pit is crossed by a line of rails, which facilitates tipping a mould or casting into it and for loading wagons with broken pieces. Above are a large sheer-legs, fitted with an underground hydraulic capstan, breaking up being effected by the primitive but very effective method of dropping a lump of iron weighing about 2 tons upon the mould or casting below. A slip hook releases the weight after it has been drawn up, and the lifting gear enables the moulds, castings and broken pieces to be manipulated as desired.

The next department calling for attention is the forge. Here are three steam hammers, of 5 tons, 3 tons and 2½ tons weight respectively, three shearing machines for cutting up scrap metal, a circular saw for hot metal, seven hydraulic and hand cranes, and a merchant mill for rolling iron bars, with five sets of rolls driven by a heavy duplex steam engine. A curious feature is



THE 1,000TH LOCOMOTIVE BUILT AT CREWE WORKS—DECEMBER, 1866.
SIX-COUPLED EXPRESS GOODS ENGINE.

Designed by Mr. Ramsbottom.

Cylinders	17 in. by 24 in.	Grate area	15 sq. ft.
Coupled Wheels	5 ft. diameter	Weight of Engine in working order	28 tons 4 cwt.
Steam Pressure	140 lbs. per sq. in.	Weight of Tender, loaded	25 tons
Heating Surface	1,068·3 sq. ft.		

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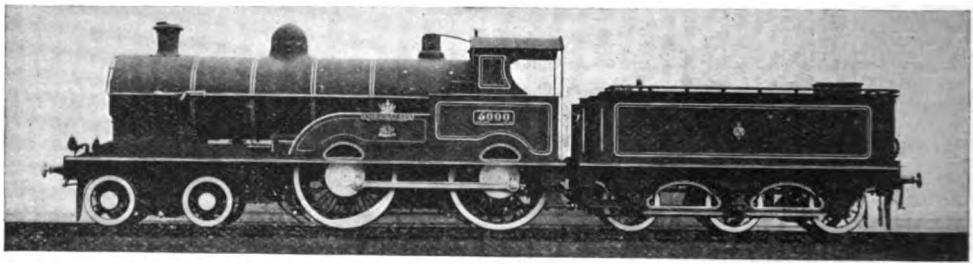
the employment of an old locomotive engine—complete with bunker and other details except wheels—for driving the general machinery. Adjoining is a similar shop where fish plates are made and springs rolled. There an old locomotive is similarly utilised, forming, in fact, a duplicate of the driving plant in the forge. Four sets of rolls, a 15 cwt. steam hammer, two shearing machines, a circular saw and a composite punch (driven by its own steam engine and punching rivet holes in the fish plates and taking off the rough edges) may be specially noted.

Adjoining is the axle forge and tyre mill. There are four steam hammers in operation —the heaviest being 8 tons and the lightest 50 cwt.—and two powerful hydraulic forging presses, one giving a pressure of 1,700 tons and the other 2,000 tons. The latter is fitted with an electric turning over gear to facilitate the handling of large blooms and slabs. In the centre are two enclosed engine-rooms, each, one would think, sufficiently powerful to drive all the machinery of this shop, and possibly that of one or two others. But as a matter of fact one of these engines —of duplex type—is reserved exclusively for operating the tyre rolling mill, where tyres up to 8 ft. 9 in. diameter can be rolled. On this machine tyres for the carriage and wagon departments, as well as for engine wheels, are rolled, and 650 can be turned out in an ordinary working week. The other enclosed engine pumps water for the hydraulic accumulators. A still larger vertical engine (with 30 in. by 42 in. cylinder, and fitted with special hydraulic reversing gear) is employed for driving a plate and axle mill having four sets of rolls, designed to give, if required, the necessary taper to axle forgings. Two 7 ft. circular saws designed for rotating at very high speed, and capable of cutting through a 9 in. axle in about half-a-minute, are driven by independent steam engines. A punching machine for cutting out tender and engine frames also has its own steam engine of diagonal type. The remaining machines, including powerful shears and miscellaneous punches and shears, are driven by a wall engine. Twenty hydraulic and hand power cranes, lifts and hoists provide for lifting requirements.

This range of buildings is completed by a series of end-on erecting shops, Nos. 5, 6, 7 and 8. All four are of the same type, consisting of two three-road bays and a centre arcade for tools and miscellaneous purposes. No. 5, used mainly for repairing saddle-tank engines, has four 25-ton overhead electric cranes, two in each bay. No. 6 has four 40-ton electric cranes, so that it may be utilised for large modern engines. In addition there is a hand-operated travelling crane for lifting wheels, while an electric traverser enables engines to be brought in and out of the shops from an outside road. A number of tools are seen in the arcades and elsewhere, including wheel lathes, drilling, slotting and planing machines, cylinder and coupling rod boring machines, electric tube cutters, and portable horn block facing machines (wherein 12 faces can be machined at once). No. 7 shop is used for boiler



THE 5,000TH LOCOMOTIVE CONSTRUCTED AT CREWE WORKS—1911.
4–4–0 EXPRESS LOCOMOTIVE (SCHMIDT SUPERHEATER).

Designed by Mr. C. J. Bowen Cooke.

Cylinders	20½ in. by 26 in.	Grate area	22·4 sq. ft.
Coupled Wheels	6 ft. 9 in.	Weight of Engine in working order	59 tons 17 cwt.
Steam Pressure	175 lbs. per sq. in.	Weight of Tender, loaded	39 tons 5 cwt.
Heating Surface	1,849·65 sq. ft.		

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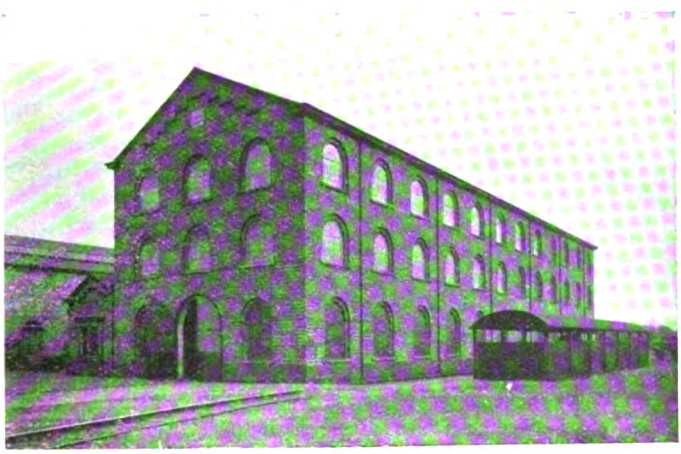
mounting, the boilers when received from the boiler shop being there fitted with lagging, tubes, brass mountings and fittings. They are also tested here, and outside is a steaming shed where boilers are tried under steam, a temporary smoke-box being fitted for the purpose. Four 25-ton electric overhead cranes provide the necessary lifting power. In No. 8 shop larger engines are rebuilt and repairs executed. There are four 40-ton overhead electric cranes and one 10-ton hand crane, together with incidental machines. An electric traverser between Nos. 7 and 8 shops enables engines to be brought in midway from the outside.

Between the two ranges of building described, and in addition to the plate stores, flanging shop and angle iron smithy mentioned, are the various boilers required for the gas producers, steam hammers and the score or so steam engines in the departments on either side. North of the axle forge and steel foundry are the coppersmiths', wheel and axle, and nut and bolt shops. In the coppersmiths' shop, tools for making piping and various copper articles are at hand, together with plant for brazing steel ends on tubes, galvanising bath for galvanising tender and tank plates, and the requisite furnaces. The adjoining wheel shop is well equipped with suitable machinery. In an annexe at one end tyres are shrunk on to wheel rims, gas furnaces being used for heating.



THE NEW STORES BUILDING.

Space does not permit of detailed mention of the tools provided in the main shop, but among them may be specially noted a series of four machines erected along the wall for drilling and tapping holes in rims and tyres, the machines being placed in a pit so that the work is received at floor level. There are also two large duplex tyre turning and boring mills by G. Richards & Co., an electric machine for turning crank pins in position, several Craven centre-drive duplex wheel and axle lathes, two face-milling lathes for ends of axles, mounted on one frame, a "nibbling" machine for cutting out the throws of crank axles, radial arm and other drills, wheel lathes of various capacities (the largest able to take wheels 8 ft. 9 in. diameter), slotting machines for crank webs, multiple and special drills and slotters, milling machines, axle and other lathes, presses for forcing wheels on to axles (cold), and presses for removing wheels and for removing crank and coupling rod pins. Power for this shop is provided by two large 30 h.p. gas engines in an enclosure at the east end, and all the tools except one of the big wheel lathes, which is motor-equipped, are driven by belting and shafting. Two 4-ton and 6-ton electric travelling cranes provide for lifting requirements. The adjoining nut and bolt shop is operated by a duplex gas engine. A large number of the machines are automatic or semi-automatic, boys and apprentices being mainly in charge. In one section shearing and pressing machines turn out completely formed nails of any size, shape or description, each bearing on its head the initials "L.N.W.R." if the dimensions permit. Other machines make ferrules, washers, nuts, rivets and screws, while single and multiple machines for screwing and tapping bolts and studs, stays, nuts and screws, single and multiple nut-facing, slot-cutting (for screw heads), bolt turning and like operations are also included.

North of these buildings is another series of shops. The signal fitting shop, 280 ft. long and 85 ft. wide, has an assortment of drilling, planting, punching, grinding, slotting, screwing, tapping, sawing and milling machines. A Hetherington multiple-tool miller for quadrant castings (as used in signal frames) whereby several faces are

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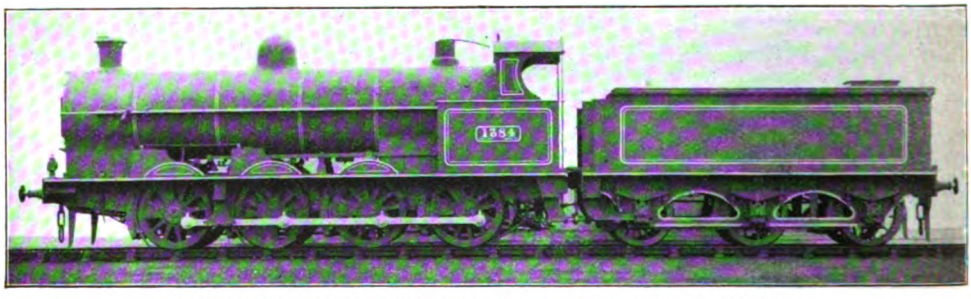
machined simultaneously may be specially mentioned, as also several millers, vertical and horizontal, by W. Muir & Co. One side of this shop is mainly devoted to the erection of interlocking signal frames and similar operations. Electric train staff apparatus is here constructed, as well as the standard signal and interlocking mechanisms. A gas engine supplies the necessary power. Adjoining is a stores building, and above is a wood-working section, where station name-boards and notice boards are made and repaired. A short distance to the west is the brass foundry. Here are two large melting furnaces for the heavier castings, and also ranges of crucible furnaces, the gas for these being supplied from two producers standing outside. Moulding machines are largely used, as much of the work is of a repetition character. Jiggers and separating machines for dealing with the moulding sand and refuse are likewise employed.

division. Various machines are included for wood-working, while one section is devoted to making metal patterns as used for the moulding machines, appropriate tools being installed, and adjoining is a large pattern store.

Entering the iron foundry from the pattern shop, a section devoted to the casting of points and crossings and special chairs first comes under notice. In the large foundry—462 ft. long and 121 ft. wide—machine-moulding is strongly in evidence. There are 7 cupolas, with capacities ranging from 2 cwts. to 30 cwts. The pig iron and coke required for the larger cupolas are raised in wagons by means of hydraulic hoists to a platform level with the cupola mouths. One 20-ton, two 10-ton, and two 5-ton electric travelling cranes, with various hydraulic and hand cranes; wheel, cylinder and other moulding machines, and grinding mills are in use. A section is reserved for



0-8-0 MINERAL ENGINE (SCHMIDT SUPERHEATER)—1912.
Designed by Mr. C. J. Bowen Cooke.

Next thereto is the tender shop, one of the finest in the works, being 530 ft. long and 121 ft. wide. Here all tenders, as well as the tanks for tank engines, are made and repaired. Six 6-ton electric travelling cranes are available, and the machinery (located principally in one bay, while the other forms an erecting shop) includes various shears, a Craig & Donald (of Johnstone, near Glasgow) multiple punch capable of punching 50 plates simultaneously, and the usual planing, slotting, drilling and corresponding machines, with a few lathes for tyres, wheels and axles. Pneumatic and hydraulic rivetting tools, portable electric drills, and rivet-heating furnaces, complete the equipment. An electric traverser is placed midway, and power for the shop is obtained from an electric motor. At the rear of this building is the pattern makers' shop—a large and exceedingly important

making malleable iron castings. Continuing westward a brick making yard is entered. Here are drying houses, Hoffman kilns for ordinary red bricks, a moulding house for making tuyeres and pipes for the steel-making plant, and clay-mixing and other machines.

The large erecting shop and adjacent fitting shop situate at the far western end of the works area may now be described. No. 9 erecting shop, built in 1902, is 463 ft. long and 110 ft. wide. It is reserved almost entirely for erecting and repairing the largest modern engines, many of which cannot be dealt with in the other erecting shops. There are here four 40-ton and one 4-ton overhead electric travelling cranes. The general design is the same as in several of the other erecting shops—two three-road bays, with an arcade between them. At one end a few wheel lathes and drills are

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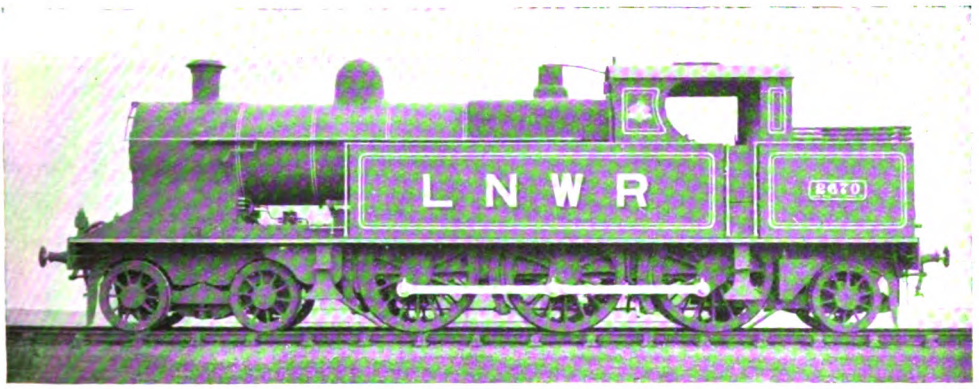
provided, and there are other tools in the arcade. Another space is used for erecting bogies, while at the further end a frame-fitting stand is employed. Upon this the frame plates are erected and cylinders, motion plates, stay plates, foot plates and hornblocks bolted and rivetted in position ready for transfer to the erecting pits. Electric lighting is employed, as in most of the later built shops, and a high pressure water-heating plant is installed. Outside is the boiler yard, where boilers are placed ready for use, and engine stores are adjacent, while an overhead gantry enables the boilers to be lifted and transferred as required.

The new Fitting Shop shares, with its companion in the Old Works, the distinction of being one of the most interesting divisions to the mechanical engineer. Between it and the erecting shop is an arcade used for miscellaneous purposes. At one end plate, cab and tank work is done, and further along axle box and like jobs are undertaken, a few machine tools, with fitters' benches providing the mechanical equipment. The remaining space accommodates cylinder castings and various parts that are ready for passing into the fitting shop. On the occasion of my visit, Mr. Bowen Cooke's *chef d'œvre*—No. 2222, bearing the name of *Sir Gilbert Claughton*, the honoured chairman of the Company—was receiving, at the end of the arcade, certain small alterations after having run its trial trips.

The fitting shop itself is 463 ft. long and 83 ft. wide. Two 4-ton electric overhead cranes provide lifting power. Shop power is entirely electric, group motors being as a rule used, while a few machines have their own motors. A large Hetherington frame slotter, with three heads and capable of slotting 10 frame plates simultaneously, an older duplex long-table frame slotter, and a duplex slotter for hornplates, together with a series of big Hetherington radial drills for frame plates, some with 2 or 3 heads, may first be noted. Beyond, in addition to numerous standard machines of various sizes, classes and capacities, are grinders for trueing piston and valve rods, vertical and horizontal boring mills, a Craven vertical face miller, a Craven duplex drill, Whitworth vertical millers, a large Craven slotter for machining two axle box faces at once, two Craven horizontal axle-box "nibbling" machines, and other tools, single and duplex, by various makers, Messrs. Cravens (Limited) being largely represented.

In the adjoining bay are seen two large duplex facing machines for heavy castings, several cylinder boring and combined cylinder and piston valve casing boring machines (the majority being directly motor-driven), two large Muir face millers for machining cylinder castings, a Uke & Spencer (Manchester) face grinder for slide bars, a duplex slot-drilling machine by Kendall & Gent, with an extensive assortment of single, duplex and multiple boring, turning, planing, slotting, drilling and other machines, and a large number of milling tools. A hydraulic press for forcing brasses into coupling and connecting rods may also be mentioned. At the end of this bay are several fitting benches. The shop is lighted by electricity and warmed by a hot-water system.

Having now completed our tour round the works, a few features which



4–6–2 TANK ENGINE (SCHMIDT SUPERHEATER).
Designed by Mr. C. J. Bowen Cooke.

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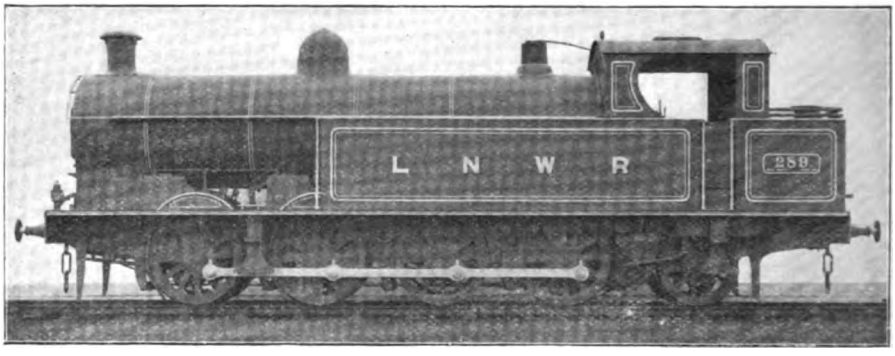
apply generally to all may be referred to.

A complete telephonic system connects the offices and the whole of the shops, rendering communication over their large area easy and expeditious. Besides the offices, several of the shops are lighted by electricity, the incandescent system being used for the former and the arc system for the latter. A fire main, with water at a pressure of 100 lbs. per square inch, is laid through that part of the works where the more inflammable shops and materials, such as the Joiners' Shop, the Saw Mills, and the Timber Yard are situate. There are also two hydraulic mains for serving most of the hydraulic machinery at the Steel Works, one at 400 lbs. pressure per square inch for the ordinary machines, and the other at 2,000 lbs. pressure per square inch for the more powerful pressure. Steam is supplied to the engines at the Steel Works from 16 stationary boilers, 30 ft. long by 7 ft. diameter, and from 24 boilers of the locomotive stationary type. The former work at a pressure of 80 lbs. and the latter at 100 lbs. per square inch. All these boilers were made at Crewe of Crewe steel. Besides the ordinary 4 ft. 8½ in. gauge railway connecting the various parts of the works, there is a narrow gauge railway, 18 in. wide, traversing every part of the premises, its total length being about 5 miles. It is worked by small locomotives, which draw trains of strong, low-wheeled trollies, conveying materials and finished work from one part of the works to another. Examples of the narrow and standard gauge locomotives used about the works are illustrated.

As an inducement to the apprentices and young men employed to improve themselves in the knowledge of electrical engineering, the Directors of the Company have had one of the rooms at their Mechanics' Institution in the town fitted us as a laboratory for lectures and demonstrations, in each week one afternoon being set apart for the special instruction of such of the employés as show aptitude for the work and attend the evening Science Classes at the Institution. This educational agency has given most gratifying results, and many men who have made great progress in this branch of work owe their advancement to the early training there received.

Photographs are reproduced showing locomotives recently designed and built at Crewe, though it is unnecessary to refer to them in detail as virtually all classes have from time to time been fully described in the pages of the RAILWAY MAGAZINE. Two photographs, representing respectively the 1,000th and the 5,000th locomotives built at Crewe, the former in 1866 and the latter in 1911, will also be of special interest.



0-8-2 MINERAL AND YARD SHUNTING ENGINE—1912.
Designed by Mr. C. J. Bowen Cooke.

Mr. C. J. Bowen Cooke, the Chief Mechanical Engineer, entered the Crewe works of the Company as a premium apprentice early in 1875, and in 1878 became a private pupil of the late Mr. F. W. Webb. Appointed in 1880 assistant to Mr. A. L. Mumford, then Superintendent of the Running Department for the Southern Division, he remained in that position until April, 1899, when Mr. Whale took over the control of the Running Department. Mr. Cooke then became assistant to that gentleman in the Southern Division. On July 1, 1903, when Mr. Whale became Chief Mechanical Engineer, the Running Department was again

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divided into two divisions—North and South—and Mr. Cooke was appointed to take charge of the latter. He was still holding that position when, at a Board meeting on February 19, 1909, the Directors selected him to succeed Mr. Whale after that gentleman's retirement on the 30th June, 1909. Mr. Cooke is a member of the Institution of Civil Engineers, and the Institution of Mechanical Engineers. He is well-known as a writer of text books on the history, construction and development of the locomotive engine. He is also a magistrate for the county of Chester.

Mr. W. W. H. Warneford, the Works Manager at Crewe, was born on July 14, 1866, and is the youngest son of the late Canon Warneford, M.A., of Warneford Court, Wilts. Educated at Newark Grammar School and St. Mark's, Windsor, he entered upon an apprenticeship at the Lancashire and Yorkshire Railway Works, Miles Platting. He left in 1883, to go, as a premium apprentice, to the London and North Western Railway Company's works at Crewe, there becoming private pupil for four years under the late Mr. F. W. Webb. In March, 1889, he was appointed Assistant Manager of the works, and was placed at the manufacturing end, having under his charge the Bessemer plant, Siemens-Martin melting furnaces, rolling mills, forges, foundries, contract work, and gas works. That position he held for 21 years, and on Mr. A. R. Trevithick's appointment as Superintendent of the Wagon Works at Earlstown, in May, 1910, Mr. Warneford was raised to the position of Works Manager. He was one of the first officers of the Crewe Railway Engineer Corps, formed in 1887, and retired with the honorary rank of Major.

Mr. J. N. Jackson, Chief Draughtsman at Crewe, was born at Lancaster, in March, 1852. Educated at the Royal Grammar School in that ancient borough, he afterwards became a premium apprentice at the Phœnix Foundry in that town. Shortly after the completion of his apprenticeship, he went to the works of Messrs. Laird Bros., Birkenhead, remaining there some time, and afterwards taking up a position with a firm of agricultural and general engineers in the North of England. In February, 1875, he joined the service of the London and North Western Company at Crewe. Entering the drawing office in the early part of 1876, he was appointed Chief Draughtsman in August, 1888. He also joined the Crewe Railway Engineer Corps on its formation in 1887, and retired with the rank of honorary Major on the disbandment of the Corps by the War Office in March, 1912. He holds the Volunteer Officers' Decoration (V.D.) for long service. On the formation of the National Reserve he was appointed by the Cheshire Territorial Force Association "District Commandant" of the Reserve for Crewe and surrounding district.

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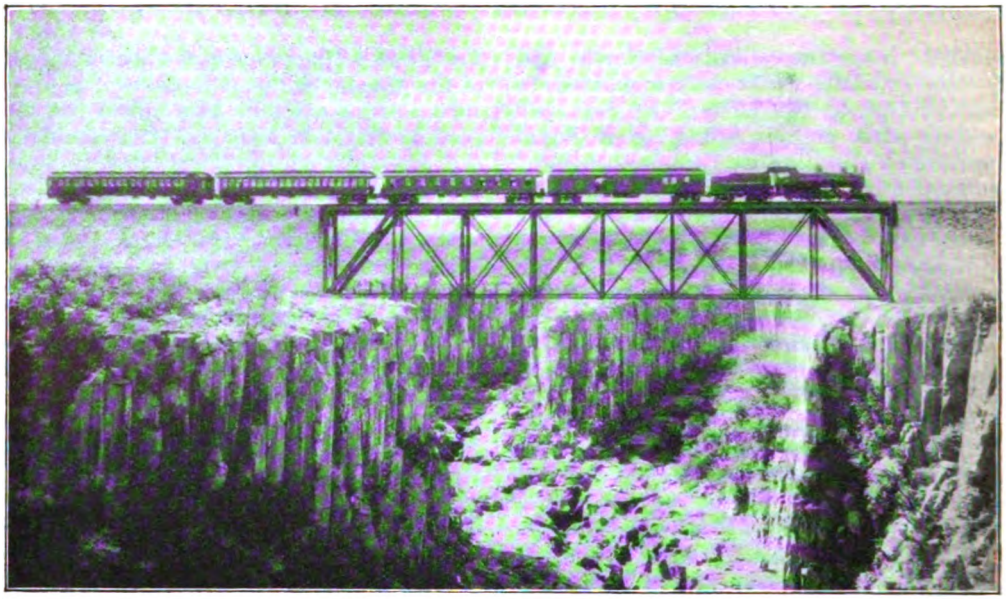

NATIONAL RAILWAYS OF MEXICO: CHONE RIVER BRIDGE.

Mexico's Great Railway System:

PROGRESS OF NATIONAL LINES.

By AN OFFICIAL CORRESPONDENT.

NOTWITHSTANDING the troubled condition of the Republic of Mexico, new construction on the National system is steadily progressing. A branch connecting Penjamo with Ajuno on the Pacific division, approximately 85 miles in length, is well advanced towards completion. A section was opened for traffic between Penjamo and Zacapu—a distance of 50 miles—on the 12th January last, and a daily mixed train service is run in both directions. This branch opens up a fine corn and wheat country already under cultivation.

Another important branch now being built is from Allende, in the State of Coahuila, on the ex-International Railway, to San Carlos, a distance of about 50 miles, with a probable extension to the frontier at Las Vacas, on the Rio Grande. This section was provisionally opened for traffic between Allende and Esmeralda—a distance of 30 miles—earlier in January. The line runs through a good agricultural district, capable of great development, and there are already a number of irrigation projects under consideration. On the San Carlos Hacienda particularly are 70,000 acres of irrigated lands. The chief products raised are cotton, corn and beans, and the Hacienda is attracting a considerable number of immigrants. Other Haciendas on the line are raising similar produce, as well as melons and other fruits. Cattle rearing is also carried on to a considerable extent in the district, and this branch promises to be a valuable feeder to the railways.

But the most important construction on hand is that which will soon connect the ports of Tampico and Veracruz. Work here is proceeding rapidly, about 4,000 men being in the "camps." During the last fiscal year the total amount expended on these and other new lines exceeded £1,000,000. In that period new passenger stations were built at Iguala, Cuernavaca, Balsas, Colima, and Aguascalientes, and up-to-date freight stations at Iguala, Balsas, and Linares. Under competitive conditions, previous to the merger, San Luis Potosi possessed two

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SCENE ON THE TUXPAN-COLIMA BRANCH OF THE NATIONAL RAILWAYS OF MEXICO

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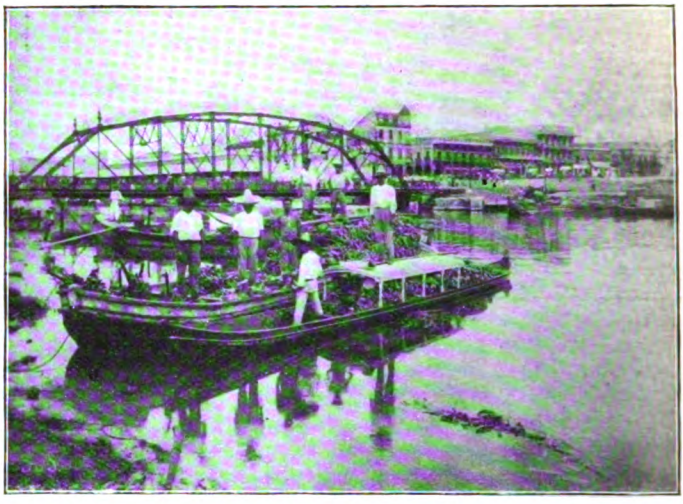
stations—one owned by the ex-Mexican Central Railway, the other by the ex-National Railroad. In view of the growing traffic, both are inadequate, and to replace them a modern terminal is in course of construction.

At the present time the National Railways have four separate stations in Mexico City. The inconvenience of such multiplicity has for some time been recognised, and plans have been formulated by the President of the company for the erection of one large passenger station. It is estimated that this structure will cost $4,000,000. The expenditure of this sum has been definitely authorised by the Board, and plans for a joint freight station are also under consideration.



BRINGING FRUIT DOWN TO TAMPICO FOR SHIPMENT.

As a striking contrast, many readers of the RAILWAY MAGAZINE will no doubt be surprised to learn that Mexico can boast the possession of the oldest railway station in the world, which is situate at Cuautla, on the Interoceanic section of the National Railways, Mexico. It was built in 1657 as a votive offering by Dona Catarina Calderon, the owner of a neighbouring Hacienda, and for two hundred years was used for ecclesiastical purposes. During the reign of Maximilian the edifice was occupied by the Franciscan Fathers, who later were compelled to vacate it when the order of 1856 appropriating church property to the Government was enforced. It remained unoccupied until 1881, when the Interoceanic Railway purchased it, and from that time to this day they have used it as a railway station. The original inscription, "*Terriblis est iste hic domus dei et porta coeli*"—"This is terrible. This is the House of God and the Gate of Heaven"—still remains over its door as if in mute protest against the worldly purposes to which the building is now devoted.

Although owing to revolutionary troubles and consequent interruption of traffic, a slight decrease in gross earnings was recorded in 1911-1912 as compared with the previous year, the management of the company has very considerably reduced the cost of operation, with the result that the net income for that year shows an advance of over £100,000. The greater portion of this increase can be traced to the use of oil instead of coal for fuel, the saving in cost being approximately as much as £87,000. On such a vast system it is economically impossible to burn oil exclusively, bearing in mind that some sections are a very long

ANOTHER VIEW OF CUAUTLA STATION.

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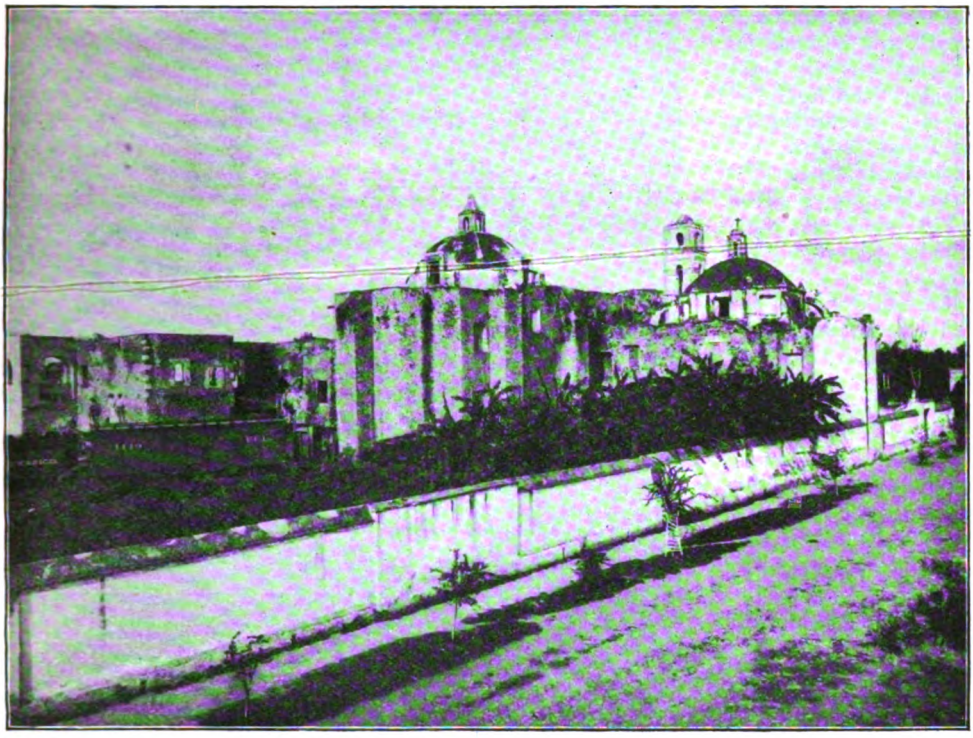
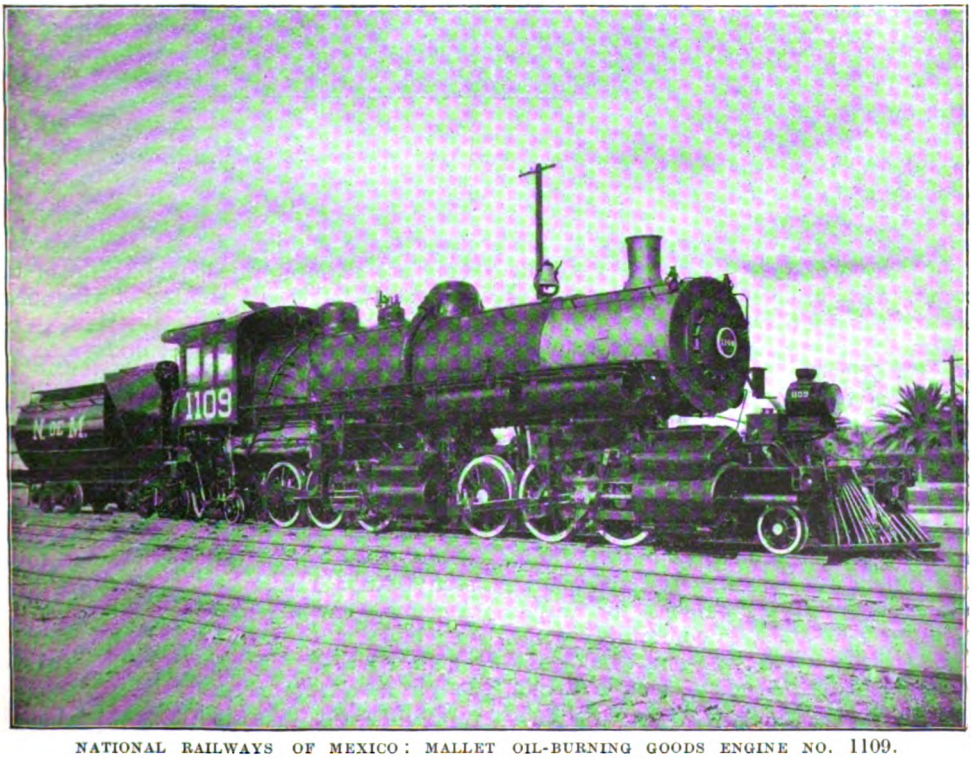


CUANTLA STATION, THE OLDEST IN THE WORLD.



NATIONAL RAILWAYS OF MEXICO: MALLET OIL-BURNING GOODS ENGINE NO. 1109.

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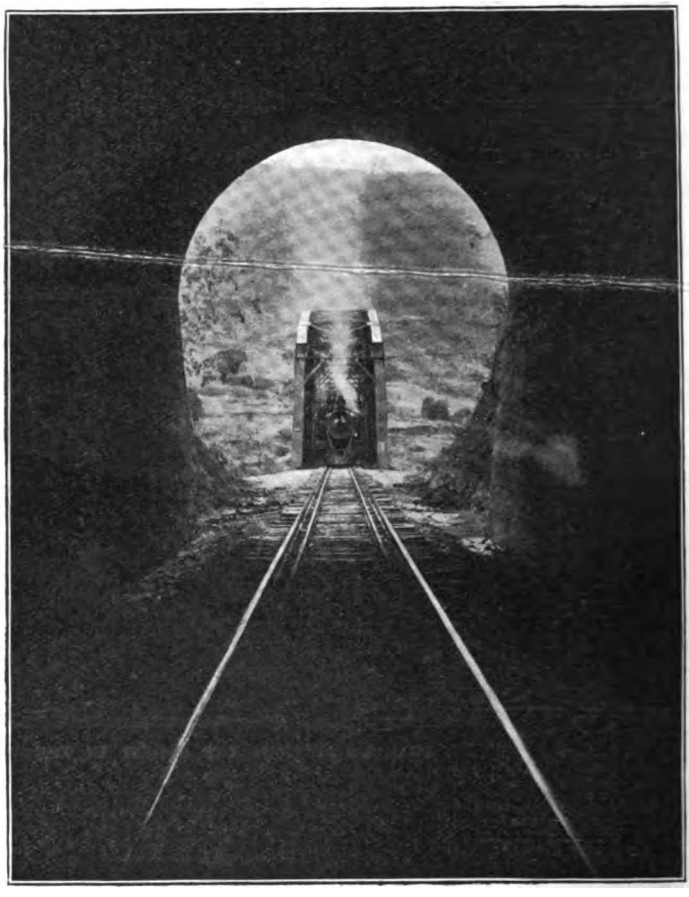
way from the source of supply, and roughly 50 per cent. of the total mileage is now operated by oil. According to the latest returns, the employés in the service of the company number 31,179, of whom 639, or 2·05 per cent. are foreigners.

Mention was made in the RAILWAY MAGAZINE (January, 1913) of the Port of Tampico. Since then an extremely interesting consular report has been issued showing how rapidly trade through that port is developing. The total value of the imports and exports for 1911 exceeded £14,036,000, as against about £13,400,000 through the rival port of Veracruz. Although the full figures for 1912 are not yet available, the supremacy of Tampico during the past year will be found to be even greater. A considerable factor in this progress is the impetus given to the oil trade in the Tampico and Tuxpan districts. New wells have been sunk with gratifying results, while the old wells keep up a steady output, and altogether the prospects of this business are extremely promising.



FIRST BRIDGE AND TUNNEL SOUTH OF TUXPAN ON THE TUXPAN-COLIMA BRANCH OF THE NATIONAL RAILWAYS OF MEXICO.

With a view to improve the port, an order has recently been placed for the construction of a large suction dredger, which is expected to be delivered at Tampico by the end of next month (May). By means of this dredger it is anticipated that the depth of water will be so much increased that steamers of the largest tonnage can enter and leave the port at any state of the tide. To accommodate business men and sportsmen—Tampico being famous for tarpon fishing—a new hotel, to contain 82 rooms, all furnished in luxurious and comfortable fashion, is now in course of construction, and two similar buildings are in contemplation. These will be greatly appreciated, as the existing accommodation is entirely inadequate to meet the requirements of the constantly increasing number of visitors to the city.

Wherever one may travel in Mexico the scenes presented are always fascinating, and often extremely beautiful. In particular, there is the trip from Mexico City to Guadalajara, the second city of the Republic, thence to Manzanillo, on the Pacific Coast—a moving picture of continuous beauty—past Colima and the volcano of the same name, which is the only live volcano to be seen from a railway on the continent of America. The difficulties to be overcome in the building of this branch of line were abnormal even for Mexico, as the photographs here reproduced will show.

For instance, between Tuxpan and Colima—a distance of 43 miles—the earth work

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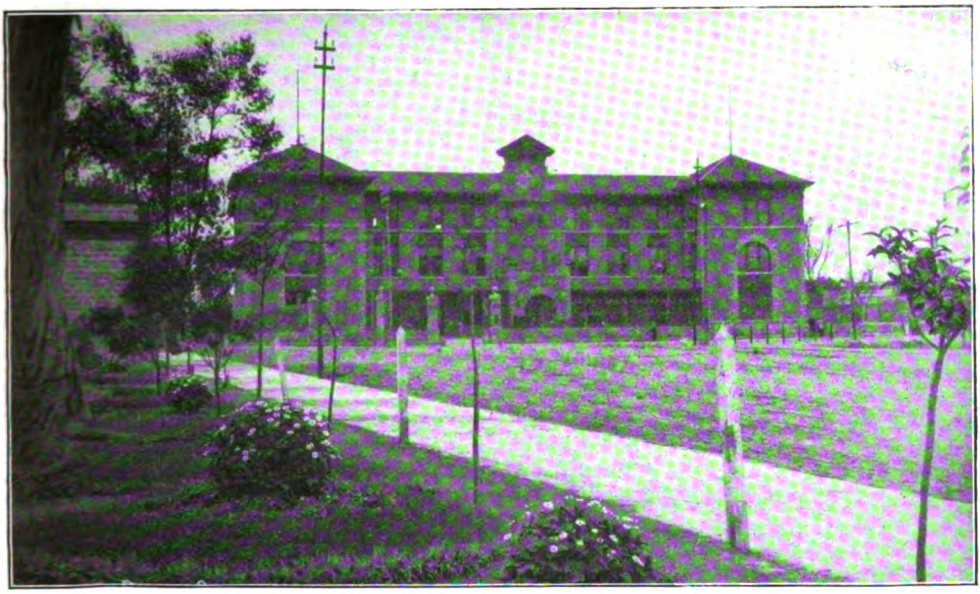
averaged 140,000 cubic yards per mile. In this short distance, fifteen tunnels were required, with a maximum grade of 1 in 50 and a curve of minimum radius of 501·5 ft. A number of curves extend into the tunnels, and reverse curves occur in two of the tunnels. Owing to the numerous streams coming into the main cañon from the slopes of the Colima volcano, bridging on this section is also extremely heavy. A bridge 197 ft. high and 471 ft. long is carried over this cañon, and at one point the barranca Santa Rosa is crossed with water 279 ft. below the rails. Although no extensive panoramas can be obtained, the scenery, as may be imagined, is wild and picturesque in the extreme. Beyond the divide it is possible at one point to see no fewer than five different levels of track one above the other on the mountain side.

Southeast and south from the City of Mexico, the lines of the Interoceanic section of the National Railways extend towards the Gulf of Mexico, through the states of Puebla and Veracruz, with branches into Morelos and Guerrero. Winding round the foot of the extinct volcano of Ixtaccihuatl, by the shores of Lake Texcoco, through farms and haciendas, across the Llanos of Puebla, the main line of the Interoceanic connects the City of Mexico with the seaport of Veracruz by way of the cities of Puebla and Jalapa. Puebla is the third city of the republic, being exceeded only by the capital and Guadalajara in wealth, commercial importance and number of inhabitants. Its population is 101,000, and elevation 7,058 feet. Puebla is celebrated for the number and elegance of its churches. The Cathedral is remarkable for the fine onyx used in its adornment. It is one of the largest cotton manufacturing centres in the republic, and the distributing point and commercial centre of a wealthy and important district.

Jalapa, the capital of the state of Veracruz, is a city of flowers, located in a region of perpetual spring, at an elevation of 4,467 feet above sea-level. The population is 25,000. There is no more beautiful place on the line of this road, or in Mexico, than Jalapa. The territory through which the main line of the Interoceanic passes, on leaving the plateau in which lies the valley of Mexico, is for a long distance, on its way to sea-level, through what may be called the great temperate zone of Mexico. Lands of the foothills and in the valleys on the slope leading down to the gulf are well watered and of an exceeding richness for agriculture, fruit growing, or pasturage of cattle. Constantly swept by the winds from the gulf, the heat is never excessive.

The scenery along this line is very



COLONIA STATION, MEXICO CITY.

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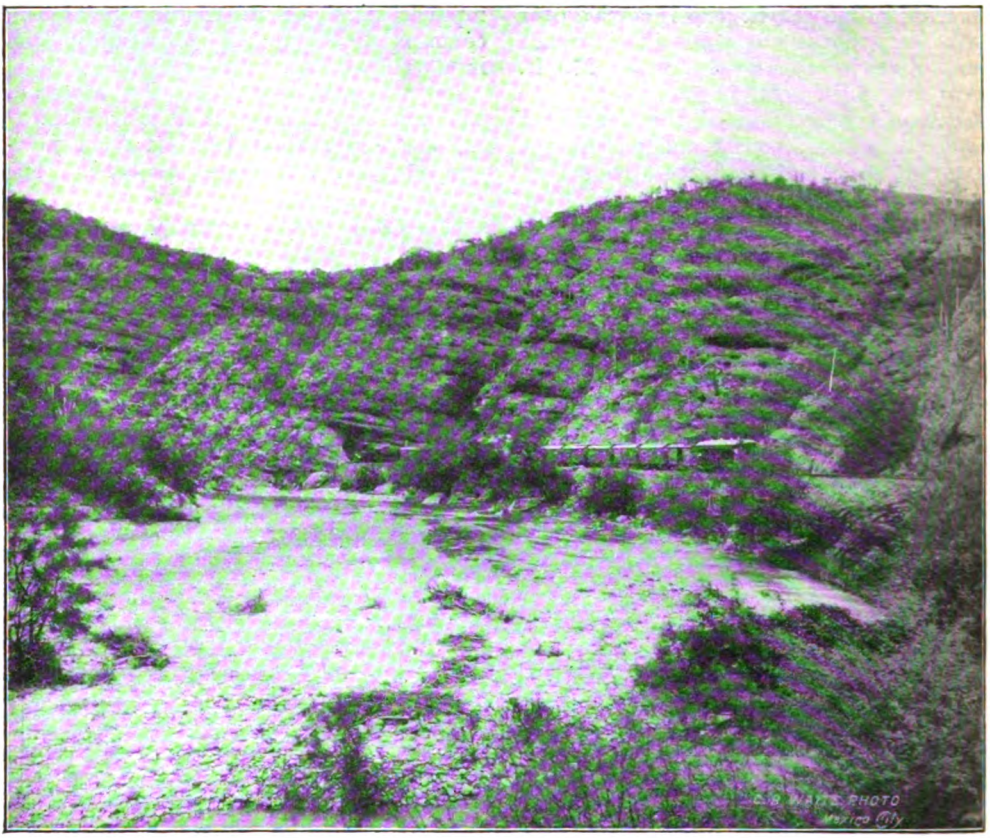
beautiful, and in many places the railway crosses the old stone paved road leading from Veracruz to the Capital City, over which couriers ran to advise Moctezuma of the coming of the Spaniard. Branches of the Interoceanic reach many outlying districts rich in agriculture, and especially in timber lands. On one of the branches is located Cuautla, Mexico's great health resort, where the hot sulphur springs have been declared to be a remedy for almost all human ills, while by way of Puebla, and in connection with the Mexican Southern branch, a through sleeper service is maintained over the Interoceanic to Tehuacan, where are located the famous mineral springs which furnish a large part of the table water to the capital.



CANON DE LOS CUEZ, MEXICAN SOUTHERN RAILWAY.

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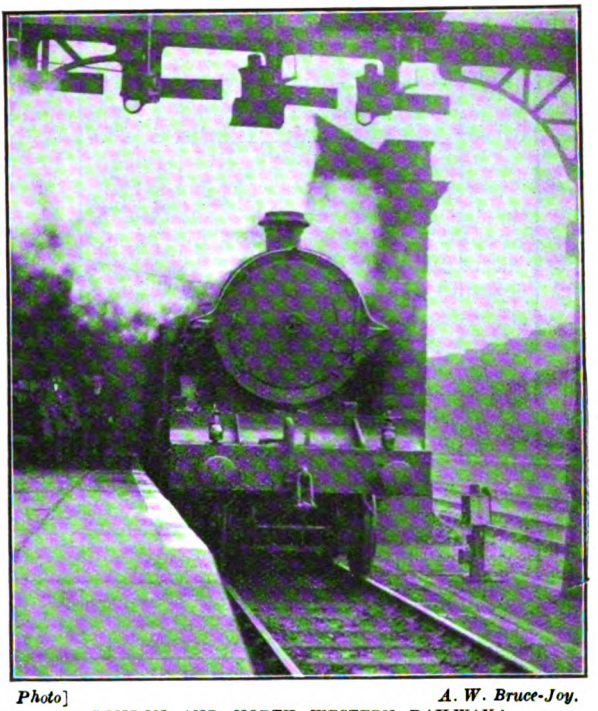
British Locomotive Practice and Performance.

By CECIL J. ALLEN.



Photo] *A. W. Bruce-Joy.*

LONDON AND NORTH WESTERN RAILWAY:
New four-cylinder engine *Sir Gilbert Claughton* at Crewe.

SO many letters have reached me in connection with the article which appeared in the February RAILWAY MAGAZINE descriptive of "Shap" performances on the London and North Western Railway that I must give them immediate attention, while the subject is fresh in mind. The most detailed, and on that account the most interesting, of the letters comes from a correspondent who has evidently made a special study of the working over this section of the North Western system, and who forwards a tabular statement of his best superheater and non-superheater runs between Carnforth and Shap Summit. "My experiences"—this correspondent writes—"are really more wonderful still, although made, as yours, without the drivers' cognisance, and I have quite come to the conclusion that Mr. Bowen Cooke's superheater engines are, for their size, easily the finest locomotives I have ever travelled behind." To my friend's somewhat severe comparisons with the work of certain other well-known locomotive types I will not refer, but will proceed to an analysis of his experiences, which I have tabulated in conjunction with the more noteworthy of my own. I have distinguished my runs by the numbers which they bore in the original tables I. and II.; those of my correspondent by the letters which he used in his communication—A, B, C, D and E; and that of another correspondent, to which run I shall refer later, with an X.

The chief merit of these runs to me lies in the fact that on three occasions a load of 50 axles, or even more, was taken unassisted over the summit. In the first of these instances the engine was actually a non-superheater "Experiment," whose effort far transcended, not only those of all the "Experiment" runs which I timed, but also the more noteworthy feat referred to in last month's issue. The speed up Grayrigg bank in particular deserves notice, being superior to that of the superheater engines on several occasions with smaller loads. Indeed, there is little to choose between this run and the average of those made with superheater engines, save that this was undoubtedly an exceptional effort, whereas the superheater runs, as far as I at least am concerned, represent all that I have yet made, and, therefore, average everyday performance.

Turning to my correspondent's superheater runs, the first point of note that I find in run A is a contradiction of my remark in the February issue that "no driver could observe" the 13 min. schedule between passing Carnforth and Oxenholme. I really meant to say that none of the drivers whose work I timed *could* observe the time, in the sense that none actually *did* do so, although I must confess to some scepticism as to whether it were possible, seeing that the

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TABLE III. LONDON AND NORTH WESTERN RAILWAY—CARNFORTH TO SHAP SUMMIT.

	Non-superheater.				Superheater.									
No. of Run	4	5	6	C	8	A	B	14	12	10	13	X	D	E
Engine	Majestic	City of Carlisle	Fortuna	Grey Stoke	Defiance	Cyprus	Cyprus	Cyprus	Prince of Wales	W. C. Brocklehurst	George the Fifth	——	Deerhound	Racehorse
Type	4-6-0	4-6-0	4-6-0	4-6-0	4-6-0	4-4-0	4-4-0	4-4-0	4-6-0	4-4-0	4-4-0	4-4-0	4-4-0	4-4-0
Load (axles)	42	42	44	50	38	40	40	44	46	48	48	48	52	56
,, (tons)	285	285	310	340	270	280	280	305	330	340	340	340	370	390
7¼ Carnforth-Milnthorpe	7.35	7.55	8.10	7.31	7.20	6.42	‡9.39	‡10.05	7.25	7.10	7.00	6.44	13.54	7.27
5⅝ Milnthorpe-Oxenholme	7.20	†8.35	7.25	6.57	6.00	5.56	*6.48	*6.30	6.45	7.10	6.20	6.15		6.59
7 Oxenholme-Grayrigg	13.00	12.15	13.10	11.33	9.15	10.30	*12.02	*12.45	11.30	11.45	11.05	11.18	11.20	12.08
6 Grayrigg-Tebay	7.00	6.50	6.50	7.04	6.30	6.04	5.59	6.25	6.25	6.25	6.40	6.42	5.44	6.48
5⅝ Tebay-Shap Summit	10.10	11.00	11.20	11.13	8.10	¶10.12	8.41	9.10	8.25	¶8.35	10.00	9.28	8.46	8.54
31½ Total	45.05	46.35	46.55	44.18	37.15	¶39.24	‡* 43.09	‡* 44.55	40.30	¶40.55	41.05	40.27	39.44	42.16
Minimum speed, Grayrigg (m.p.h.)	30.6	31.3	30.3	§33.6	39.5	§38.3	——	37.5	36.0	33.3	32.8	§31.6	§32.1	§31.9
Minimum speed, Shap S't (m.p.h.)	23.5	21.2	21.7	§20.7	29.9	¶14.0	§27.9	26.6	28.5	¶22.5	22.5	§24.1	§27.7	§25.0

§ Average speed over last half-mile to summit in each case.
† Check at Milnthorpe Junction.
‡ Time from Start at Carnforth.
‡* Times to and from dead stop at Oxenholme.
¶ Low minimum speed due to slipping near summit of bank.

total distance of 12⅞ miles includes 8¼ miles up, inclined from 1 in 103 to 1 in 182. Here, however, was an instance of covering this stretch in 12 min. 38 sec.—more than 40 sec. under my fastest times, obtained on runs Nos. 8 and 13. Curiously enough, this same point formed the burden of the correspondent's letter whose run appears in column X, and who, on his first recent journey over this section, secured a time of exactly 13 min., to within a second.

In both instances, however, these fast times were secured by dint of exceptionally hard running from Lancaster to Carnforth. The time on run A from passing the extreme south end of Preston station (including the usual very slow passage through and the acceleration up the rising grades to Barton) to passing Carnforth, 27¼ miles, was only 26 min. 10 sec.—quite a record in itself and nearly 1¾ min. better than the best of my own times. The fast running through Carnforth thus gave a good impetus for the short rise beyond, and enabled the wonderfully smart time of 12 min. 38 sec. to be achieved to Oxenholme. It will be noticed, however, that the time up Grayrigg bank, although good, was quite inferior to my own time with *Defiance*, which I imagine must have constituted a record of the first water. The time up Shap was comparatively poor, but this was occasioned by the violent slipping of the engine near the summit, reducing the speed to 14 miles per hour. Judging by the work up Grayrigg bank, however, an unimpeded climb of Shap incline would not, I think, have yielded a total time equal to mine with *Defiance*, whose climbing was altogether a finer performance. The merit of run A, as previously mentioned, lies in its Carnforth-Oxenholme time. To run from Barton right up to Tebay also—as was accomplished on this occasion—in almost exactly "even time" is, to say the least of it, a startling feat. The time of 65 min. 34 sec. from Preston to Shap

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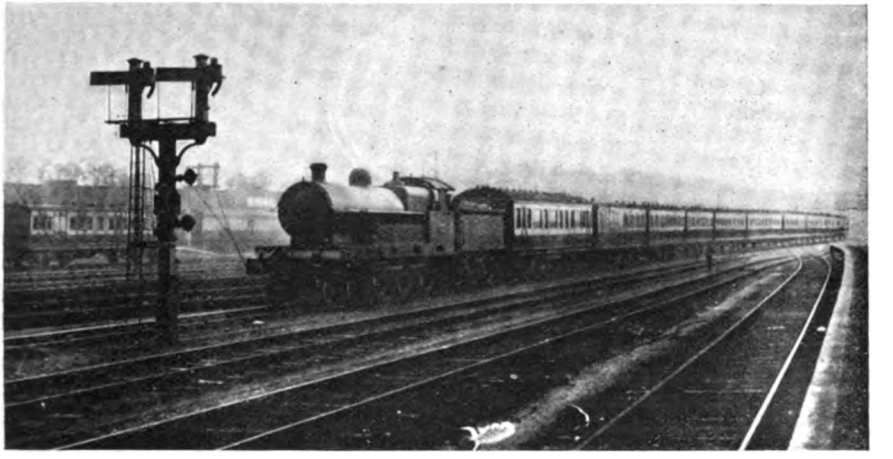
summit, despite the slow running at the finish, was within $\frac{1}{2}$ min. of the old 65-min. racing schedule which was in force prior to the Preston accident of 1896.

Run B forms a companion to the run 14 of my own, with which I dealt at some length when writing in February, save only that, *mirabile dictu*, even finer times were recorded. The load was lighter, it is true, but the small difference was certainly not sufficient alone to account for the substantial increment in time. I wish that my friend could have furnished me with details of the acceleration from Carnforth and from Oxenholme, but these were not forthcoming with his record. With a faster start from Carnforth, but a slower stop at Oxenholme, it will be seen that the time between the two points was one of 16 min. 27 sec.—8 sec. faster than my own. Even more surprising was the start from Oxenholme, whereby an economy of 43 sec. was effected to Grayrigg, while some high speed must have followed between Grayrigg and Tebay to secure a time of 5 min. 59 sec. for this 6 miles, including as they do the moderate speed past Grayrigg. As on my run 14, however, the work up Shap incline was more moderate. I should be very glad to know whether any reader has recorded a performance on any other line in this country with a 4–4–0, with a 4–4–2, or even a 4–6–0 engine, comparable with that related, where an engine hauling 280 tons, starts from rest on an incline of 1 in 182, accelerates up 7 miles inclined from 1 in 133 to 1 in 100, and finally, after a brief level stretch of 6 miles, tackles a bank of $1\frac{1}{2}$ miles at 1 in 147 and 4 miles at 1 in 75, the whole $18\frac{5}{8}$ miles from the dead start occupying 26 min. 42 sec. !

The run marked X was also an excellent effort, the principal feature of which was the 12 min. 59 sec. time from Carnforth to Oxenholme, this achievement, as mentioned, inducing my Newcastle correspondent to forward the same to me. Here again this fast time was obtained as the result of very smart running from Lancaster to Carnforth, this distance of $6\frac{1}{4}$ miles being covered in 5 min. 3 sec., at an average speed of 74·3 miles per hour, with a fastest mile at 76·6. The times throughout this run, made on the 2 p.m. train *ex*-Euston, are worthy of mention. Starting $8\frac{1}{2}$ min. late from Preston, Lancaster, 21 miles, was passed in 23 min. 27 sec. ; Carnforth, $27\frac{1}{4}$ miles, in $28\frac{1}{2}$ min. ; and Oxenholme, $40\frac{1}{8}$ miles, in 41 min. 29 sec. No startling speed was achieved up either long incline, although each of the two times, as well as the total from Carnforth to Summit, were good. From Preston to Shap Summit the total was 68 min. 57 sec. for the $58\frac{3}{4}$ miles, which would have allowed amply for an economy of 5 min. on schedule time, but for the usual very cautious running down the falling grades to Penrith, and signal checks beyond. On this occasion the same engine achieved some remarkable times from Crewe with the full load of



Photo] [*A. W. Bruce-Joy.*

LONDON AND NORTH WESTERN RAILWAY :
New four-cylinder 4-6-0 express engine, *Sir Gilbert Claughton*, hauling a special train from Rugby to Crewe.

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410 tons. From the start the first 9 miles occupied 12 min. 2 sec., and then, with speed ranging between 68 and a maximum of 73½ miles per hour, the next 15¼ miles to Warrington were covered in 13 min. 19 sec., giving a total of 25 min. 21 sec. from Crewe. An excellent speed was also maintained beyond to Wigan, which was passed in 37 min. 20 sec. from Crewe—a time altogether finer than any that I had recorded on this train. Unfortunately, a severe signal check followed—as usual on Boar's Head bank—so that what might have proved quite an exceptional time to Preston with this load was in the end one of 59 min. 20 sec. This was a shade over schedule time, but certainly equivalent to a net time of not more than 55½ min.

Turning now to the final runs timed by my first-mentioned correspondent, we find truly enormous loads hauled unpiloted over a road of this character. Run D, on the 2 p.m. down, is, perhaps, the finest of all in the series, as, despite the exceptional load, the times over every section are good, and, indeed, better than many achieved with lighter trains. The time of 5 min. 44 sec. from Grayrigg to Tebay must have involved a truly "lightning" spurt from Grayrigg summit, showing the extraordinary accelerative powers of these engines on the level. Run E was made with an unpiloted load which must surely represent the limit for this section—if there *be* any limit, which I begin to doubt!—the train consisting of 11 eight-wheelers and 2 twelve-wheeled dining cars, reckoned in London and North Western figures as 20½ vehicles. I am much indebted to my correspondents for these figures. My own times up both Grayrigg and Shap inclines with *Defiance* still remain unbeaten; but, beyond that, the laurels evidently go to the 4–4–0 engines, which seem capable of performing almost any feat.

A further correspondent, whose candour must be one of his chief characteristics, wrote me recently asking "what do you propose to do for superlatives when you have to record the coming performances of Mr. Cooke's new 4–6–0 four-cylinder engines?" adding that I might really have kept "a few in reserve!" To which I would fain reply, in the familiar injunction, "Wait and see!" At the same time, with such performances as these in view, I cannot see what can be the object of designing further engines with such a marked increment in power, unless the intention be to unite such of the expresses as at present run permanently in duplicate. These remarks lead me to mention a communication from a Derby correspondent, whose faith in the superiority of British locomotive performance, as expressed in the foregoing runs, has been rudely shaken by the perusal of an article in a contemporary on the work of some recent balanced compound 4–6–0 locomotives on the Prussian State Railways. The passage which excited his attention read as follows:

> The new engines are reported to be doing excellent service on hilly as well as level sections; for example, on the Grunewald-Mansfeld line, taking a car-load of 470 tons up continuous inclines of 1 in 100 at the remarkable speeds of 34 to 38 miles per hour without forcing the boiler. On level lines car-loads of 593 tons, or total loads of 736 tons, have been run at 59·4 miles per hour.

"Now," my correspondent asks, "if the London and North Western runs are the finest feats of hill-climbing you have recorded in this country, what is the reason for their great inferiority to the German performances?" First of all I may deal with the figures just mentioned. "Up continuous inclines of 1 in 100 at the remarkable speeds of 34 to 38 miles an hour" is a delightfully vague expression, which may mean anything. The writer of the letter immediately seized upon these figures as indicating the minimum speed at the summit of such inclines, but as no definite statement to this effect is made in the article in question, I see no reason why the 34 and the 38 should not, as is more likely, represent continuous or *average* speeds rather than minimum speeds. To compare the Prussian engine's performance with that of the London and North Western locomotives on this basis gives a very different result from that which my correspondent obtained. For instance, the average speed of *Prince of Wales*, hauling 330 tons from Oxenholme to Grayrigg—the whole of which distance is inclined at 1 in 100 or nearly so—works out at 36·4 miles per hour; those of *W. C. Brocklehurst*, *George the Fifth*, and the 4–4–0 in run X, each hauling 340 tons, at 35·8, 38·8 37·2 miles per hour respectively; that of *Deerhound*, hauling 370 tons, at 37·1 miles per hour, and that of *Racehorse*, hauling 390 tons, at 34·6 miles per hour—all, as will be seen, between the magic figures 34 and 38, save in one instance, in which the latter was exceeded.

Of course, the loads, were much lighter than that cited as being hauled by the German engine, but it is evident that,

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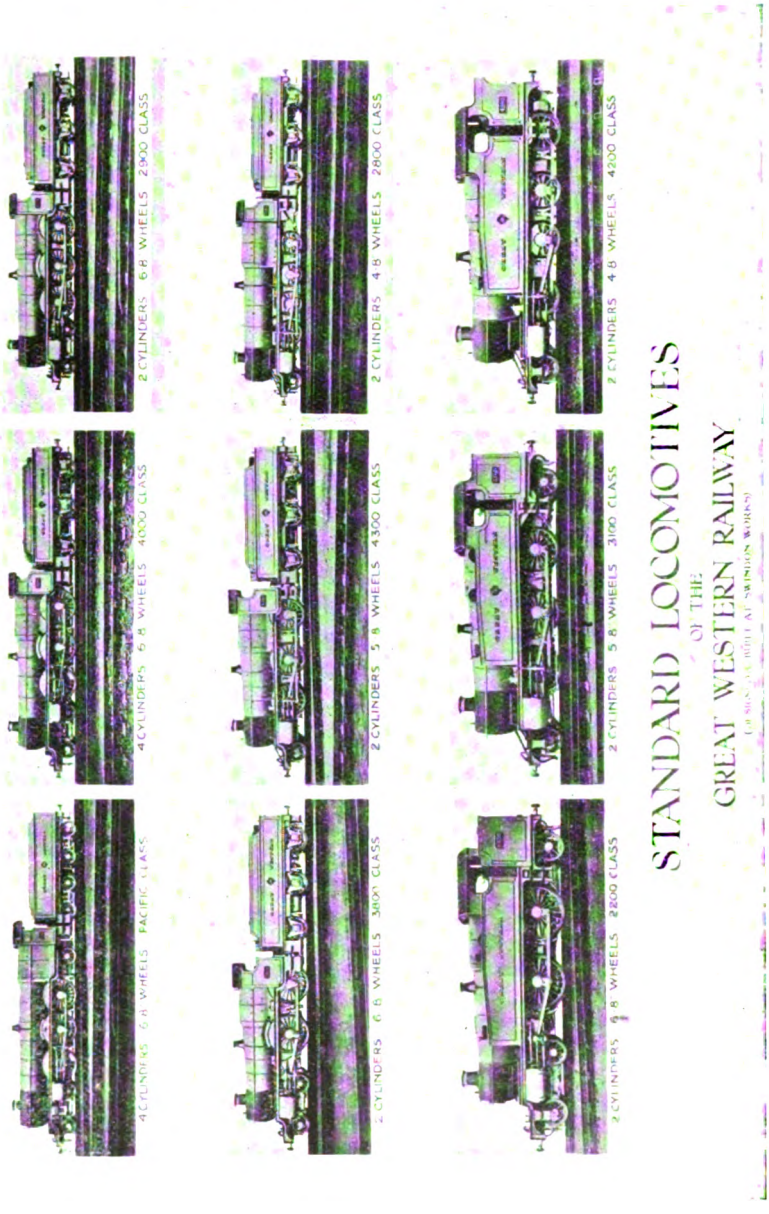
hauling even the 390-ton coach load shown in column E, the London and North Western 4-4-0 engine had not reached the limit of its capacity. In fact, the records individual engines achieved on totally different stages of the journey—for instance that on run



No. 8 from Oxenholme to Grayrigg and Tebay to Shap Summit, those on runs A and X from Carnforth to Oxenholme, or that on run D from Grayrigg to Tebay—point clearly to the fact that, generally speaking, there was still further power in reserve in all the other runs. If the record times over each length were added together we should get a total time of 35 min. 47 sec. for the 31½ miles, from Carnforth up to Shap summit, giving an average speed of all but 53 miles per hour for this clear rise of nearly 900 ft.; and I have not the slightest doubt now that one of these engines could actually achieve such a time with any load, up to at least 350 tons, if really

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required to do so. At any rate, an engine which can maintain an average speed of 37·9 miles per hour up 1⅝ miles of 1 in 147 and 4 of 1 in 75—a grade 33⅓ per cent. steeper than that cited in the case of the Prussian engine —with 390 tons, as was the case with *Racehorse* in run E, should also be able to tackle the continuous 1 in 100 with 80 tons heavier load at "34 to 38 miles per hour," if it seriously attempted to do so.

"Without forcing the boiler" is another comment which one would be glad to see clearly explained. Personally I have never known any trial run made with a new type of engine, especially in cases where the results were to be made public, on which it was not sought to secure the best possible results that the locomotive could afford. By comparison, these London and North Western runs were made in the course of ordinary working. In every instance the drivers were unaware that the running was being timed for publication, while in the majority of the runs the trains were on or before time on passing Carnforth, so that there was little object in making even such smart uphill runs as were recorded. Whatever the phrase "forcing the boiler" may imply, it is certain that if the boiler of the German locomotive were not forced on this trial run, the same is more decidedly true of the London and North Western locomotives in these examples of everyday working.

Similar illustrations could be found on other great British lines. In the excellent article descriptive of "Heavy Express Work between Paddington and Exeter," which appeared in the RAILWAY MAGAZINE (March, 1912), I find instances in which 4–6–0 locomotives took loads of 360, 365 and 380 tons up the last 3¾ miles of the Wellington bank at average speeds of 42·6, 40·8 and 34·7 miles per hour respectively. The grade is mainly at 1 in 90 and 1 in 80, although with a short stretch at 1 in 125 through the summit tunnel, and no "flying start" is obtained, as the final pull is reached by way of 9½ miles of approach grades, the last two of which average 1 in 165, and the previous two 1 in 215. A further specimen of hill-climbing was found between Bedwyn and Savernake, where, after covering 26½ miles of unbroken adverse grades—not very steep, it is true, but yet constantly "against the collar"—two of the 4–6–0 engines, with loads of 440 and 480 tons behind the tender, covered the final 3½ miles, two-thirds of which are inclined at 1 in 180, and the remainder at 1 in 144, at average speeds of 52·7 and 46 miles per hour respectively. One of the new Great Eastern superheater 4–6–0 engines has maintained a minimum speed of 46·5 miles per hour up the 1 in 84 of Brentwood Bank with 330 tons behind the tender. Illustrations such as these would therefore seem to indicate that the feat which my correspondent mentions is not one beyond the powers of British simple locomotives, if only they

Photo] [*H. T. Worlock.*

LONDON AND NORTH WESTERN RAILWAY:
4.45 p.m. down 2-hour Birmingham Express, 4–4–0 locomotive No. 2177, *Malta* (Schmidt Superheater).

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could be afforded an adequate opportunity of displaying their powers.

The second of the two performances mentioned—that of running a total car-load of 593 tons at 59·4 miles per hour on the level, does not strike me as being anything very exceptional. It is, of course, difficult to secure a record of British locomotive work under such exacting conditions, as the frequency of express train services, and, incidentally, the superior travelling facilities afforded, render such vast loads unnecessary. Still, I have one record which approaches this very closely, when, during the coal strike period, the superheater three-cylinder simple "Atlantic" No. 732, on the North Eastern Railway, with a total load of 545 tons behind the tender, succeeded in maintaining a speed of 61·6 miles per hour on the level and 57·7 miles per hour up 7 miles at 1 in 626 (in one stretch) and up 4 miles at 1 in 696. Even with a load about 8 per cent. less than that the German engine hauled, this seems to me to excel the foreign performance. On the Great Western Railway runs previously mentioned, 4–6–0 locomotives covered the 16 miles from mile-post 15 to Twyford—almost entirely on the very slightly adverse grade of 1 in 1320—with 410, 440 and 480 tons behind the tender at average speeds of 66·1, 65·4 and 63·8 miles per hour respectively, indicating a tractive capacity without a doubt equal to that of the Prussian compound on the level.

Having considered the performance aspect of the question, it is worth while to compare the dimensions of the various types referred to, as a comparison of their tractive powers distinctly favours the British locomotives, and constitutes a triumph for Mr. Bowen Cooke's remarkable 4–4–0 engines. The dimensions are as follow :—

The piston stroke of the four types is identical, affording the same leverage and range of expansion. In the three English types the area of the pistons is curiously similar, being 641 sq. in. in the case of the North Eastern engine, 638 sq. in. in that of the Great Western, and 628 sq. in. in that of the London and North Western. The high pressure pistons of the Prussian engine have an area of 390 sq. ft., and the low pressure of 905 sq. ft. Therefore, on the basis of cylinder dimensions, the four locomotives might be considered of comparatively similar power, but in the matter of steam-raising capacity the Prussian locomotive is at least nominally quite the most powerful. As compared with the North Eastern "Atlantic," the heating surface of the boiler is the same, but the grate has an area larger by 4¾ sq. ft., while the working pressure is no less than 53 lbs. higher. Compared with the Great Western 4–6–0, the heating surface is greater by 219 sq. ft., the grate area by 4¾ sq. ft.; and, although the Great Western pressure is 12 lbs. higher, it must be remembered that the Swindon superheater affords only moderate superheat against the high superheat of the German engine. As for the London and North Western engine, it is altogether smaller, having nearly 500 sq. ft. less heating surface, 9¼ sq. ft. less grate area, and 38 lbs. per sq. in. less of steam pressure.

Again, in the matter of weights the Prussian engine weighs, in working order, 3 tons more than the North Eastern Railway "Atlantic," 8 tons more than the Great Western Railway 4–6–0, and 20 tons more than the London and North Western 4–4–0! That is to say, the weight of the German compound exceeds that of the London and North Western engine with which comparison was being made by no less than 33⅓

	Compound Superheater.	Simple Superheater.		
	Prussian State 4-cylinder 4–6–0 type	N.E.R. 3-cylinder 4–4–2 type.	G.W.R. 4-cylinder 4–6–0 type.	L. & N.W.R. 2-cylinder 4–4–0 type.
Cylinders, Diameter	15¾ in. H.P. (2) 24 in. L.P. (2)	16½ in. (3)	14¼ in. (4)	20 in. (2)
,, Stroke	26 in.	26 in.	26 in.	26 in.
Driving wheels : Diameter	6 ft. 6 in.	6 ft. 10 in.	6 ft. 8½ in.	6 ft. 9 in.
Total heating surface	2,347 sq. ft.	2,340 sq. ft.	2,128 sq. ft.	1,850 sq. ft.
Grate area	31¾ sq. ft.	27 sq. ft.	27 sq. ft.	22½ sq. ft.
Working pressure	213 lbs.	160 lbs.	225 lbs.	175 lbs.
Weight in working order. Engine	80 tons	77 tons	72 tons	60 tons
Weight in working order. Tender	63 ,,	45 ,,	40 ,,	37 ,,
Weight in working order. Total	143 ,,	122 ,,	112 ,,	97 ,,
Adhesion weight	51 ,,	40 ,,	55 ,,	38 ,,

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per cent. As regards adhesion weight, the North Eastern "Atlantic" and the London and North Western 4–4–0 have only 40 and 38 tons respectively against the 51 tons of the compound, although the Great Western Railway 4–6–0 is better furnished with 55 tons. My correspondent was anxious that the weights of the locomotive tenders should be included in that of the trains, but this is a practice which I altogether deprecate, as the value of a locomotive is surely judged by its abilities to haul weight other than that of itself and its necessary supplies of fuel and water. Details of coal consumption were not appended in the article to which my friend referred, but I notice that the coal consumption of one of the previous "Hanover" 4–4–2 type engines of the Prussian State Railways on two experimental runs with 480 tons, worked out at 6,875 kilogrammes in 450 kilometres—53·8 lbs. per mile. Unless the new compound type effects a saving in fuel of more than 20 or 25 per cent. on these figures, no fear need therefore be felt on this account for the English types, seeing that the average coal consumption of both Great Western 4–6–0's and London and North Western superheater express engines works out, I believe, at between 30 and 40 lbs. per mile only, under conditions often nearly as severe.

Therefore, all things considered, the inferiority in performance seems to me to rest rather on the German than on the British side. This close comparison of dimensions and work performed also appears to place the London and North Western superheater 4–4–0 engines in the forefront of British locomotive types for efficiency in working, and at the same time on a plane substantially above the German type mentioned. For an English locomotive having but three-quarters of the weight of the Prussian compound—a rough but effective basis of comparison—to achieve results in working so closely corresponding appears to constitute a triumph for modern British locomotive design, which combines simplicity in construction with efficiency and economy in operation.

My correspondent added a query which naturally arose out of the deductions he had drawn from his comparisons. He said:—

Photo] [*R. J. Purves.*

MIDLAND RAILWAY:

9.20 a.m. Glasgow–London Express passing Hawes Junction. Re-built locomotive No. 543.

"If, as this seems to show, the compounds are so much superior to the single-expansion engine, whether fitted with superheaters or not, what is the true reason for their not being adopted in this country?" Briefly expressed, I believe it is correct to say that the comparative cheapness of fuel in this country renders any economy in this direction doubtful when the interest on extra cost of construction and royalties, as well as the increase in maintenance, are taken into account. For example, the two four-cylinder Smith compound "Atlantics" on the North Eastern Railway have proved just as successful in working as the new three-cylinder simple superheater "Atlantics." But, when all the foregoing points have been

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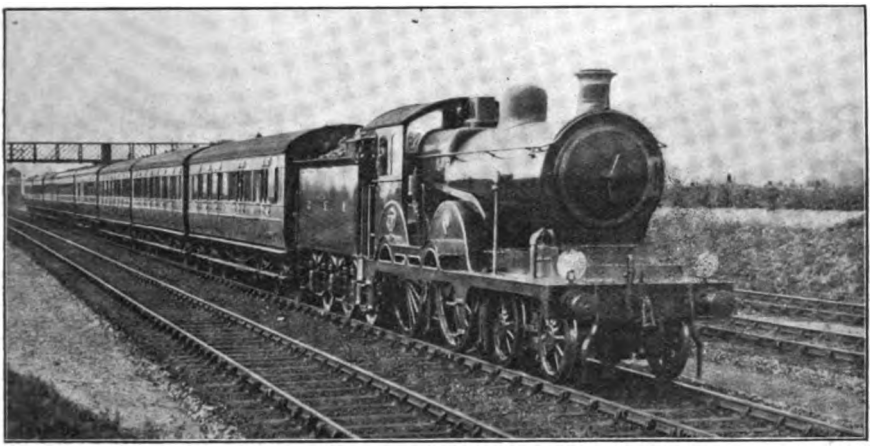

Photo] [*F. E. Mackay.*

GREAT EASTERN RAILWAY:

Down Lowestoft Luncheon Car Express. Locomotive No. 1797.

taken in consideration, they have in the end been found to be less economical, and, consequently, as a type have they not been multiplied. Boiler maintenance in the case, for instance, of superheater engines working at 160 lbs. per sq. in., bears no comparison to that of the compounds at 225 lbs.

Exactly the same has been the experience on the Midland Railway—whereon the compound locomotive has also achieved real success—and it is on that account not surprising to learn that the compound principle on that line has been definitely abandoned in favour of superheating. Economy in fuel consumption is a very desirable aim, but it must be remembered that unless coal be an expensive commodity, as is the case abroad, there are other factors in locomotive construction, working and maintenance which may nullify all that we are able to achieve in this direction. This, therefore, is apparently the "true reason" why compound locomotives are not being adopted in this country. As to their being "so much superior" to the single-expansion engines, I think my friend may now, perhaps, agree that the accuracy of his statement is entirely dependent on local circumstances.

I must acknowledge the receipt of two further letters, the arrival of which I was inclined to expect. "Would it be possible," one writer enquires from Keighley, "for you to deal with the locomotive work on the Settle and Carlisle section of the Midland Railway? The North-of-Leeds section is hardly ever mentioned, but it seems to me that there could not be a more fitting sequel to your February article than a description of hill-climbing work on the Midland." These two friends may rest content. My existing records over this fascinating stretch of line are now in process of being supplemented by some showing the work of superheater engines as compared with non-superheater, and all the records will, I hope, appear in these columns as soon as I have disposed of the South and West of England runs already promised, but necessarily held over until the next issue.

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Railway Signalling in Principle and Practice.—[No. VII.]

By W. E. EDWARDS.

"OUTER" HOME AND DISTANT SIGNALS.

ALTHOUGH each type of semaphore ordinarily used for main line signalling has already been described in the RAILWAY MAGAZINE, it may be well, briefly, to advert to that subject in order to explain a practice of comparatively recent origin, which, in certain conditions, is demanded by present-day regulations. The position of the distant signal, as the reader will recollect, is determined by a standard ratio as suited to the circumstances. In practice, however, the proximity of two, or more, signal-boxes, frequently precludes the possibility of placing the distant signals from either at the prescribed distance therefrom. Consequently, the distant arm from one cabin is placed under either the Home, Starting, or Advanced-Starting signal of the box in the rear, as conditions demand. Therefore, by way of explanation, a diagram of an existent junction is supplied in Fig. 1, illustrating also the use of "Outer" Home signals.

A is the junction cabin, situate at a distance of about 30 chains from stations B and C. No. 1, the up distant signal, is placed at the usual distance from junction box. In conformity with the practice of the railway concerned, no "splitting" or "directing" distant arms are now provided in such cases, and the main line signal is therefore lowered only for main line trains. The branch trains are thus reminded to approach the junction at "Caution," a speed restriction existing at that point. The up starting signal from the junction (No. 4) carries the usual distant arm from station B, which, as before stated, is within the distant signal limits. A "repeating," or "outer" distant arm is, therefore, likewise provided upon A's home signal, that being No. 3 upon the diagram. This distant arm is, however, "back slotted" by starting signal No. 4, for the following reason: Station B is, upon occasion, "switched out," and when such is the case, B's signals are, of course, taken off, including the controlling apparatus of the two distant arms in question. Should A, therefore, for any reason, wish to stop a train at starting signal 4, he would necessarily lower home signal 3, in order to allow such train to draw up to No. 4, that signal, as well as the distant arm it governs, being, of course, at "Danger." Hence it would be clearly be wrong for the "outer" distant (under No. 3) to be lowered, which would be the case were it not back slotted by No. 4, in the way indicated. Thus the outer distant is controlled, first, by the arm above; second, by back-slot from the starting signal; and third, by the signalman at Cabin B. The corresponding branch distant arms, below Nos. 6 and 7 are, for a like reason, similarly treated.

In the down main line direction, No. 14, the "Outer" distant from the junction, is fixed below the home signal of station B, and is again "back slotted" by B's starting signal, while, under the latter, is the "Inner" distant arm from A, No. 13. The traffic through B's station is chiefly local, non-stopping trains running only three times, or so, during a week. A's "Outer" distant (No. 14) is, therefore, lowered only on those occasions, and is, consequently, released by *separate* lever from Box A. Beneath down starting signal No. 10 will be observed an "S" or shunt arm (No. 9). This is used when trains are required to draw beyond that signal when at "Danger" in order to reach the siding indicated upon the up side. A's home signals Nos. 3 and 6 are, as may be observed, in the usual position. By reason of the position of the points connecting the siding with the down main line, further protection is required for the up trains; hence the necessity for "Outer Home" signals, as distinguished by numerals 2 and 5. By the same rule, signalman A is furnished with a down outer home signal also (No. 12) in order to protect the connection from the

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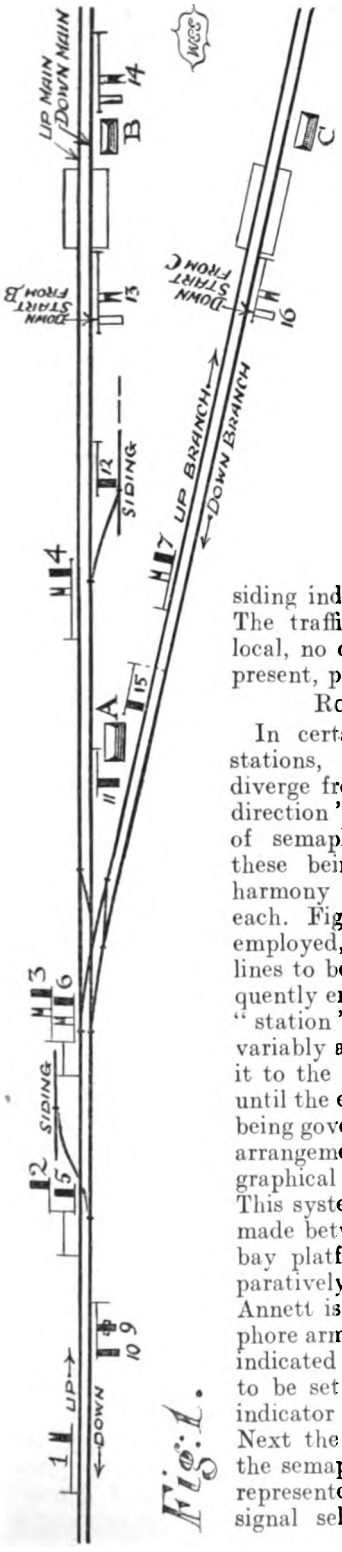
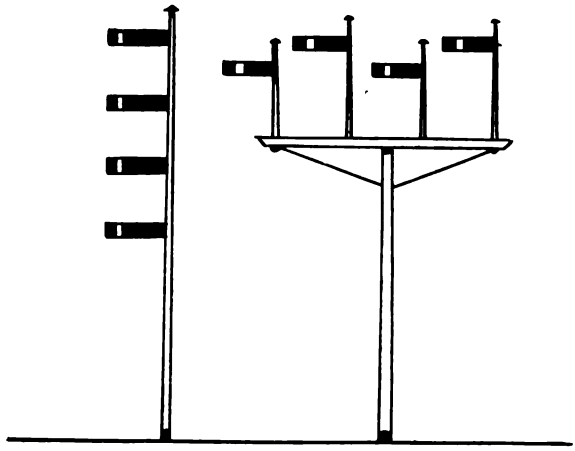


Fig. 1.



2. 3.

siding indicated in advance of that signal. The traffic from station C being entirely local, no outer distant signal from A is, at present, provided in that direction.

Route Indicating Signals.

In certain positions, such as terminal stations, where various platform roads diverge from the main line, "indication of direction" is conveyed to the driver by sets of semaphores correspondingly arranged, these being interlocked and detected in harmony with the points leading towards each. Fig. 2 illustrates the original method employed, assuming the number of diverging lines to be four. This form of signal is frequently employed in other situations within "station" limits. The topmost arm invariably applies to the left road, that below it to the next line to the right, and so on, until the extreme right is reached, that road being governed by the lowest arm. The later arrangement of the "grouped," or "geographical" type, is represented by Fig. 3. This system also allows a distinction to be made between more or less important lines, bay platforms, and otherwise. The comparatively recent plan devised by Mr. Annett is illustrated in Fig. 4. One semaphore arm alone is needed, while the route is indicated by numerals. Assuming the points to be set, and bolted for No. 4 road, the indicator is thus released by the detectors. Next the obscuring shutter is raised, and the semaphore falls, as also the numeral 4, represented by the diagram. By the use of signal selectors, which are automatic in

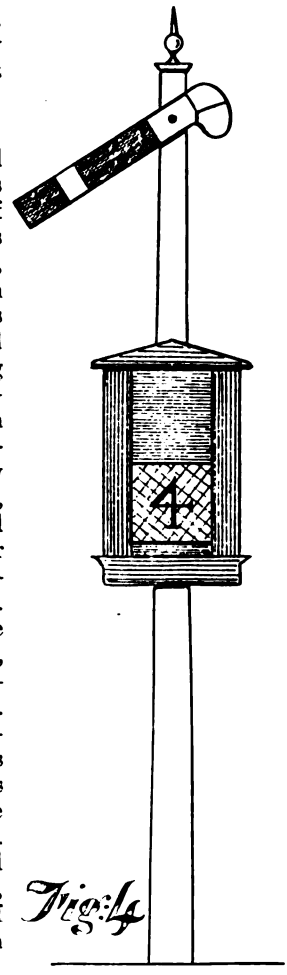


Fig. 4

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FIG. 5.

operation, it is only necessary, after setting the points, to use a single lever in lowering the signal as well as in presenting the required indication.

Normally, the indications are obscured by a shutter. The numerals are carried on a wire netting stretched upon a frame, which is lowered in front of a ground glass background. When required, the latter is illuminated by a lantern behind it. The movements are effected by upright rods (operated by lever as usual) beside the signal post, which unlock, as stated, the indicating frame, raise the shutter, and lower the semaphore, as well as cause the required numeral to fall into position. Any failure of the connections prevents the lowering of the signal, and makes any indication impossible. By the adoption of this form of signal, or of kindred designs, it may be noted that a saving is effected in signal posts, and arms, with the necessary lamps, while the use of bridges, or "gantries," is entirely avoided. Fig. 5 illustrates an electrical method, attaining similar ends, as devised by Messrs. Sykes, combining a selective route indicator with the familiar Banner signal associated with that firm. Fig. 6 reveals the interior, and indicates, in a self-explanatory manner, the selective and other electrical mechanism. Great economy and simplicity is claimed by the inventors, while by an improved design, semaphore arm and route indication alike may be operated by a minimum of eight Leclanché cells. The indicator is, of course, illuminated during operation by night.

Interlocking and Kindred Appliances.

The mechanism by means of which the interlocking of points and signals is effected, has already received attention in these pages. It is, therefore, rather with the application of that system, in conjunction with that of "fixed signals" and "block telegraph" that we are, at present, concerned. Its governing principle, as defined by Mr. A. T. Blackall, of the Great Western Railway, is that of so

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arranging "the precedence of operation and interlocking of the levers working the signals and points at a station or junction that, while any one lever or set of levers is in position for a movement of a train or engine, it shall be impossible for any other levers to be moved which would set points, or lower signals, for a conflicting movement" Fig. 7 is a signal diagram of an ordinary double-line junction and station; the numerals employed describe the levers used in operating the various signals, points, ground-disc signals, or locking-bars. In all cases the points are shown at their normal positions, *i.e.*, set for the main line. Such being so, and assuming the line to be clear, both visually and telegraphically, the signalman is in a position, therefore, to lower the main line signals in either direction. As before noted, however, the rotation of the interlocking regulates these movements. For example, either No. 27, the down main advanced starting signal, No. 28, the down main starter, or No. 29, the down main home, may be taken off at will. But in the case of the down main distant signal (No. 30) there is a difference, for before it may be lowered, it needs "releasing" by the three signals ahead, Nos. 27, 28, and 29. Thus, as already observed, the distant signal is the last to be lowered. The effect of these movements upon the interlocking mechanism is such that, by automatic action, the process is reversed, that is to say, the locks which have "freed" the distant signal lever now "back-lock" the levers (27, 28, 29) used in their release. Hence the distant signal must first be restored to "danger," next the home, and so on. In the case of the up main line, the procedure is, of course, exactly similar.

By means of other sets of locks, or wedges, the signals are dominated by the points, taking again, by way of illustration, the down main line. The opening of either points 10, 11, 14, or 16, locks the down main home signal at "danger," while the lowering of that signal, by a similar rotation, locks up at normal position the levers of the points in question. By similar mechanism, the down

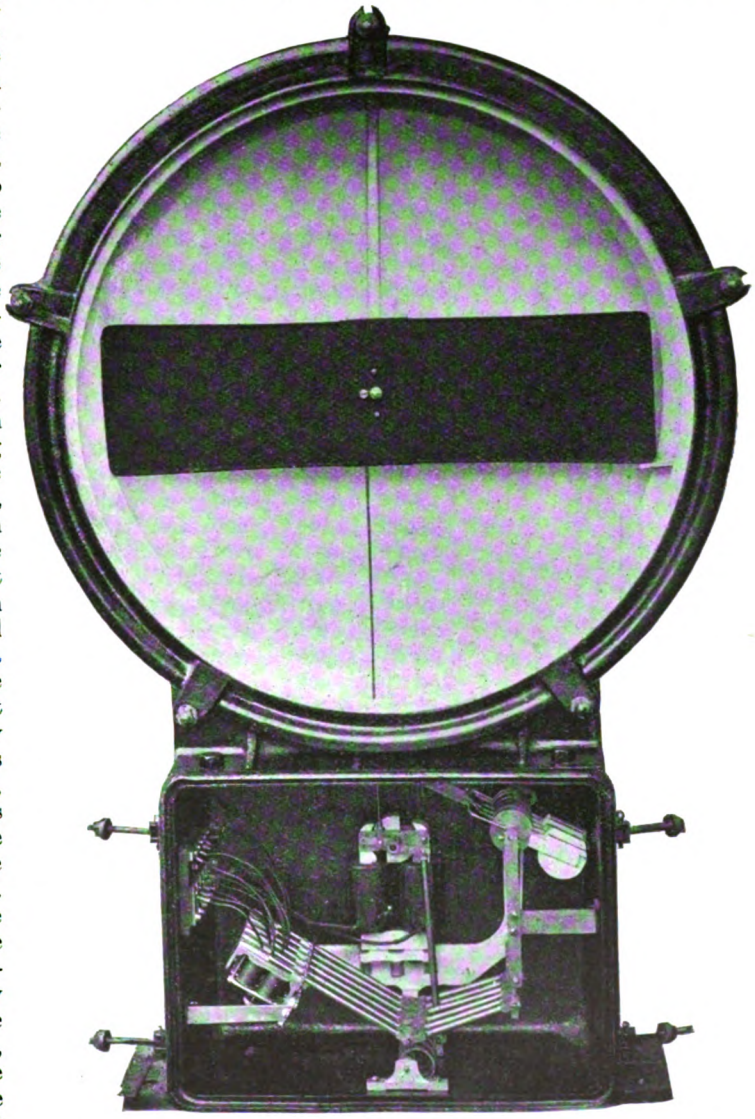

FIG 6.

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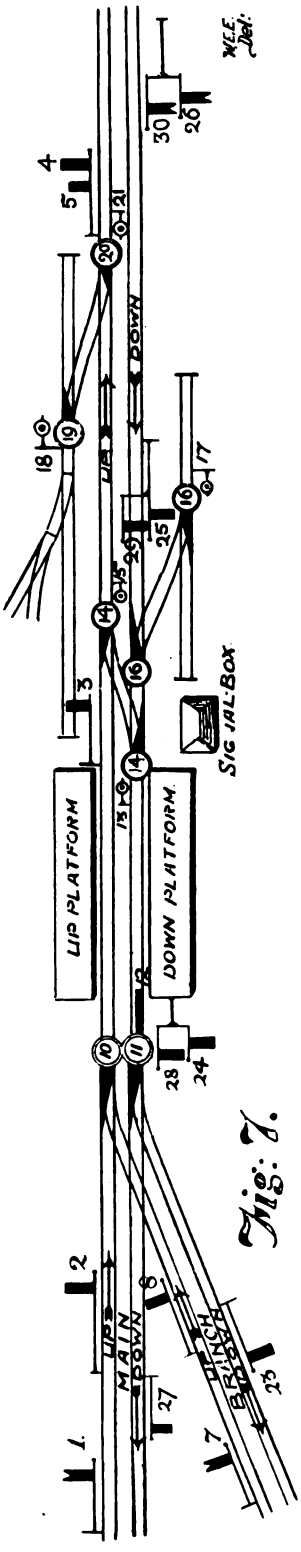

Fig. 7.

branch signals are correspondingly governed, first No. 11, the junction points must be *unlocked, opened, and relocked, before signals 24, 25, or 26 may be lowered. In order to admit an up branch train, it will be noted that points No. 10 must be opened. To counteract the possibility of a down main line train overrunning signal 28, and so causing "lateral" obstruction of a dangerous character, the interlocking requires, likewise, the opening of points No. 11, thereby ensuring the passage of any down train in the direction of the branch, so conforming with the block regulation previously referred to. Signal No. 5 is a "shunt arm," placed below No. 4, the up advanced signal. This permits a train to pass the latter in order to reach the up siding, *viâ* points 19 and 20. Owing to their distance from the cabin, the latter are not coupled in the usual way. The arrangement of the locking would be as follows:—No. 20 would precede in operation No. 19, and 19 would unlock signals Nos. 4 and 5 when 20 was "over." This would have the effect of Nos. 4 and 5 locking 19 and 20 in *either* position, ensuring that if one end of the cross-over were over, the signals could not be lowered until the other were likewise over.

It has already been noted that, in conformity with recent practice as regarding several important railways, no distant signal is provided in the case of diverging lines. Thus signal No. 26 would, in such conditions, be taken out of use, while No. 30, the main line signal, would permanently show "danger" in the case of the down branch. No. 25 may likewise be dispensed with, whether the rule mentioned be in force or not, as the necessary "indication of direction" is conveyed by Nos. 24 and 28. Upon the latter point practice, at present, varies. The distant signal regulation alluded to, is, it may be mentioned, still further extended in the case of one important system, that is to say, wherever a speed restriction exists, such as in the case of passing loops, or terminal stations, the distant arm is permanently fixed at "Danger." Curiously enough, as far as junctions are concerned, the practice indicated is only a return to the usage of many years ago; but a recommendation from the "powers that *were*," caused the introduction of the "splitting distant," although, apparently, the said authority favours the disuse of this type of signal at the present time. The question, moreover, remains open as to whether the canons of block-signalling permit of the exhibition of "signals of danger" when, in actual fact, the block is clear. Hence the view, as expressed by some engineers, that a speed reduction notice, of course illuminated by night, is probably the truer solution of the problem. It will be noted that one set of facing-points only, namely, No. 11, exist in the scheme, the outdoor mechanism being of the character illustrated and described at page 127 of the August, 1912, issue of the RAILWAY MAGAZINE. By that means the points must needs be correctly set and bolted in position before the signal may be lowered, as stated, while further independent mechanism prevents the switches being moved, or the bolt withdrawn, as long as any part of a train is passing over them. The remaining points will be observed to be of the ordinary

* Unless, as is the practice on some railways, the points normally stand unlocked, namely—with Lockplunger *out*.

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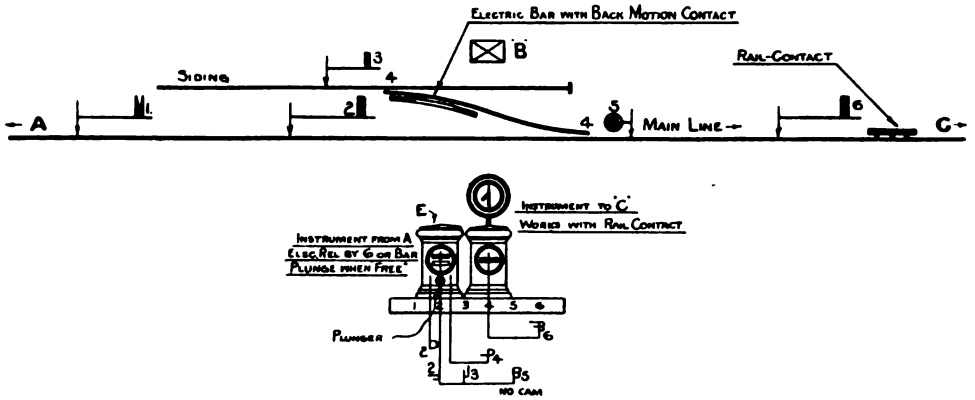
or "trailing" type. Therefore, the same precautions are not needed. The points are, nevertheless, so interlocked and detected that the ground-disc signals applying thereto cannot be turned unless the points are correctly set, while the discs are interlocked so that the signal can be given for a movement in one direction only.

Approach Locking.

Under Rule 4 of the standard block regulations, it has been shown (*a*) that, excepting under special conditions, a "train must not be allowed to approach from the box in the rear . . . until all the points over which the train has to pass have been first placed in their proper position . . . . etc.; (*b*) after permission has been given . . . no obstruction of the line . . . must be allowed, until the train has been brought to a stand at the home signal, or has passed into the section in advance, etc." Hence the system of "approach," or "route locking," has been devised by Messrs. Sykes in connection with the "lock and block" system already described, and a reference to Fig. 8 will, no doubt, explain the *modus operandi*, the dominating factor being that of "point and plunger interlocking." The appended locking table shows that a "plunge" cannot be given on block instrument E unless the siding points are set for the main line. After that plunge has been given in order to "accept" a train, the points cannot be moved until home signal No. 2 has been pulled "off," and replaced at "danger." If a train, or engine, has been admitted to the main line by signal No. 3, a plunge cannot be given, even after the points (No. 4) have been restored to "normal," until either No. 6 signal has been lowered (upon its release by a plunge from C) and replaced after the rail-contact has been operated; or, alternatively, the train, or engine, is returned to the siding by means of signal No. 5. When that signal has been turned off, it becomes "back-locked" until the train clears the fouling-bar, when its back motion gives the necessary "release."



Locking Table

Lever	Released by To Pull	To Replace	Locks
2	(Preceded by Plunger)		2. and Plunger until 6. or 5. used.
3.			2. and Plunger until 6. or 5 used.
4.			Plunger.
5.		Back motion of Bar.	
6.	Plunger at 'C'.	Rail-contact	6.
Plunger			4. until 2 is used.

J.S.L.
18.12.1911.

FIG. 8.

Block instrument E can only be plunged when "free." The system not only locks up the points in advance while a train is approaching, but ensures that, if the points are not correctly placed, no train can approach. Although the "approach locking" system has become generally known in consequence of the extended use of "track-circuiting," it did not originate therewith, nor is its use confined to that system. The object is, as the foregoing shows, to carry out mechanically the standard block regulations, rather than to rely upon the signalmen themselves.

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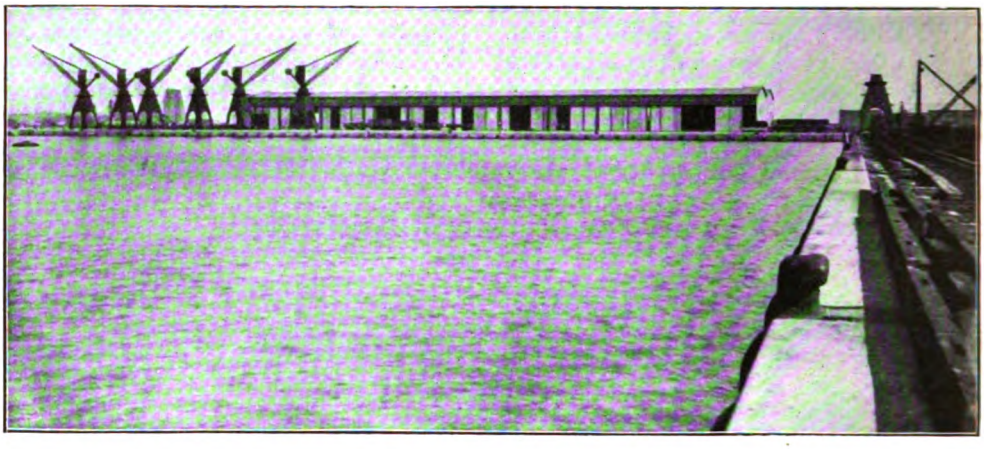
Immingham Dock: Great Central Railway.

Accommodation for P. & O. Steamships.



THE accompanying photographs show the extensive accommodation provided at the new Immingham Dock by the Great Central Railway Company for the steamships of the Peninsular and Oriental Company, which regularly call at that port *en route* to India, China and Japan. The quay and exterior of the transit shed are seen in the upper illustration, while the lower view gives a good impression of the space available inside the shed for the handling of all sorts of merchandise.

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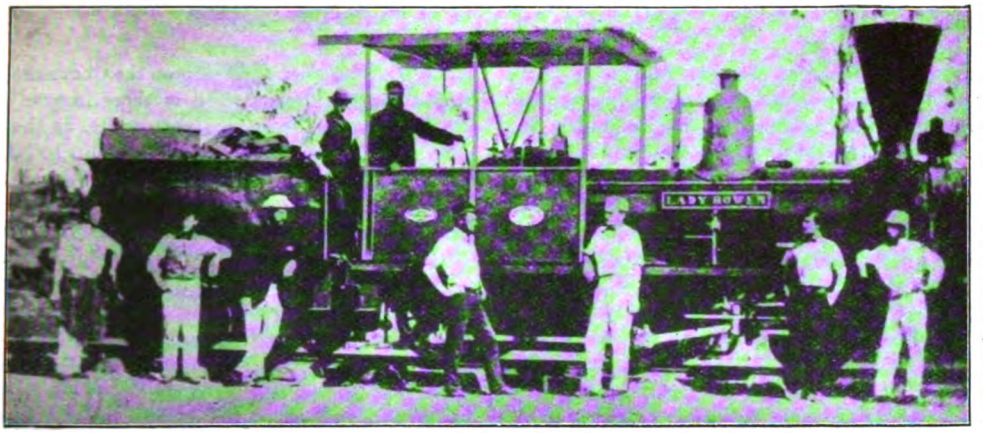

THE FIRST ENGINE EMPLOYED ON THE QUEENSLAND RAILWAYS.
(From an old print.)

Queensland's Railways.

THE February (1913) RAILWAY MAGAZINE contained a paragraph (p. 166) giving brief particulars of the vigorous policy of railway extension which has been undertaken by the Government of Queensland. We have now to thank Major Sir Thomas B. Robinson, the Agent-General of the Dominion, for a very comprehensive account of this great work, and to acknowledge his courtesy in kindly supplying the accompanying map and a valuable series of photographs, prepared expressly for the RAILWAY MAGAZINE, from lantern slides used on a recent occasion when he appeared before the members of the Royal Colonial Institute to give a review of the whole subject.

Fifty-three years ago, in September, 1859, Queensland, he then said, began her existence as a separate Australian Colony, and three and a half years later, namely, in 1863, a railway expert was engaged by the Queensland Government to report on a proposal to build a railway connecting Ipswich (which it was then thought would become the capital city, rather than Brisbane) with the Darling Downs, and at the same time to submit a recommendation as to what gauge should be adopted. A civil engineer, named Mr. Abraham Fitzgibbon, was the expert appointed, and, after a careful inspection of the country and local conditions, he furnished to the then Minister for Lands and Works a report on a proposed line of railway from Ipswich to Dalby and Warwick, *viâ* Toowoomba, in which, among other things, he recommended that the gauge should be 3 ft. 6 in. in width. In July of the same year this report was submitted to Parliament and adopted, the 3 ft. 6 in. gauge being thus accepted as the standard gauge for future railways in Queensland. The wisdom of the adoption of this gauge has been much criticised of late, but during the 47 years in which it has been in use it has never once been found inadequate for the traffic.

Those who are inclined to consider the existence of different gauges in the several Australian States as a fatal mistake in Australian railway construction are prone to overlook the fact that in India there are four different gauges of railway in existence, and that out of 31,400 miles of Indian railways, nearly one-half of the whole, is constructed on the 3 ft. $3\frac{5}{8}$ in. gauge, or $2\frac{3}{8}$ in. narrower than the narrowest gauge in use in Australia. The advantages of the 3 ft. 6 in. gauge in a new country like Queensland are, perhaps, better understood by those who have daily experience of its possibilities than by those who have a less intimate acquaintance with its merits. Because of the reduced work in cuttings, embankments, tunnels, etc., the cost of construction and maintenance is far less than in the case of the wider gauge, and in the working of the railway the comparatively lighter weight of the rolling stock gives it a great economic advantage over railways constructed on the wider gauge. For example, Queensland has constructed 4,266 miles of railway on the 3 ft. 6 in. gauge at practically half the cost of the 3,807 miles on the 4 ft. 8 in. gauge constructed by New South Wales. In a new country, where so much depends upon the provision of railway communication for the extension of settlement and

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the development of natural resources, lower cost of construction and the more rapid extension of the railway system goes far to justify the decision arrived at by those who had to settle the question in 1863.

It is a well-known fact that the demand for a uniform railway gauge in Australia emanates to a considerable extent from passengers accustomed to travel frequently between the several capital cities, and there is no gainsaying the fact that it is extremely inconvenient and disagreeable for passengers to have to exchange from one train to another during the night, as they have to, for instance, between Melbourne and Sydney, because of the break in the gauge. With a view to obviating this disadvantage as between Sydney and Brisbane, Queensland, in constructing the shorter and more direct route to the New South Wales border, which, it is hoped, will presently be available for passengers between Sydney and Brisbane, has built all her stations, tunnels, etc., sufficiently wide to permit of the construction of a track and the running of trains, similar to those in use on the New South Wales Railways, right through to Brisbane. In Great Britain the rolling stock is constructed so as to conform to the width of the gauge. Consequently railway stations, tunnels, cuttings, etc., do not permit more than a few inches of overhang on either side of the track. In Queensland it has always been the practice to allow a certain amount of overhang on each side. This has been found in practice to be absolutely safe, as well as convenient and economical, and to-day the most modern sleeping-cars running on the Queensland railways are quite as wide as those in use on British railways—as wide, for instance, as those running between London and Edinburgh. No attempt is, of course, made in Queensland to run express trains at anything like so fast a rate of speed as that of express trains in Great Britain, but trains running at a speed of from 30 to 40 miles per hour are found to be all that is necessary for present purposes.

MAJOR SIR THOMAS B. ROBINSON,
Agent-General for Queensland.

In September, 1863, the first Railway Bill was passed by the Queensland Government, and a loan of £250,000 was authorised for the construction of a line of railway from Ipswich to the Little Liverpool Range. In January, 1864, the tender of Messrs. Peto, Brassey and Betts was accepted for the construction of this line at a price of £87,869. Ten years later Queensland possessed 266 miles of railway open for public traffic, constructed and equipped at a cost of £2,929,539. After deducting the expenditure from the earnings, the net return to the State equalled 2·3 per cent. on the capital expended. From the completion of the first line to the present time the construction of railways has made steady progress, and in reporting to Parliament on September 11, 1912, the Commissioner for Railways stated that the length of railway open for traffic on June 30 last was 4,266 miles. The new sections opened during the year totalled 218 miles, and the railways under construction, but not yet in operation, equalled 1,596 miles. Plans had also been passed by both Houses of Parliament for the construction of a further 617 miles. Up to

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June 30, 1912, the total expenditure by Queensland on railways was £30,059,891. The revenue yielded by the railways now exceeds £3,000,000 per annum, and after paying all working expenses, renewals, etc., there is a net revenue of £1,115,592, equal to £4 0s. 5d. per cent. upon the capital expended on railways open for traffic.

Sir Thomas Robinson explained that in Queensland the Minister for Railways is one of the most important Cabinet appointments. At present the portfolio is held by Mr. W. T. Paget, who has had a very wide and varied experience, and has spent the greater part of his life in the Dominion. "His activity is inexhaustible, and he spends a large proportion of his time on the railway line, travelling up and down to all points of interest and importance, encouraging and assisting by his presence the members of his staff who are engaged in perfecting their organisation, surveying for new lines, or arranging for the most economical system for maintaining the existing works. It is perfectly safe to say that both in detail and in matters of broad policy no one is better informed in all that affects Queensland railways than the Hon. Mr. Paget, the Minister for Railways. I had the pleasure of travelling in his company several times, and over great distances, just about this time last year, and I had many opportunities of observing his untiring energy, and his care for the welfare and comfort of all the men engaged in carrying out the direction and the detail of the work of his Department."

The Agent General declared that the railways are run upon absolutely sound and commercial lines. They are, and have been for many years past, removed from Parliamentary control, the administration having been placed in the hands of Commissioners, who have, happily, been without exception capable and independent men, possessing, in every case, wide experience and exceptional ability. The present Commissioner is Mr. Charles Evans, who is held in the very highest esteem by the Government and Parliament, as well as by the commercial communities throughout the State; and his successful management of the railways and the railway officers and staff, who worked so loyally and happily with him even under the exceptional and trying circumstances which occurred during the recent strike, is best evidenced by the fact that during that regrettable occurrence practically the whole of the staff remained at their posts, and an efficient railway service was maintained, even during the worst of the trouble. When Mr. Evans entered the service of the Queensland Railway Department, in quite a subordinate position, Queensland had only 21 miles of railway. He now successfully manages 4,266 miles of railway, while he has a further 1,596 miles under construction. He is assisted by a staff of enthusiastic and capable officers, "in the possession of which," added Sir Thomas Robinson, "any railway undertaking in the world might well be proud."

In the early days of Queensland railways, it was thought best and most economical to call for tenders and to entrust the construction of the railway lines to contractors. In later days considerable doubt was entertained by the railway authorities as to the economy and advantage of this practice. The great economy resulting from the construction of the railways by day labour was scarcely realised until quite recently, but on September 25, 1912, Mr. Paget placed at the disposal of Parliament some returns prepared from data which had been compiled at his request by the Railway Department. He tabled a return, prepared in 1897 by the then chief engineer, of all railways built by him under contract between 1881 and 1893. The total amount expended was £5,491,720, the mileage 1,144, and the average cost per mile was shown to be £4,796. This return included all railways built between 1881 and 1896 in the southern division, a few in the central division, but none in the northern division, where the cost of labour is generally higher. A similar return had been prepared by the Department covering all railways built by day labour since its adoption in 1900 up to 1911. The total expenditure was £3,413,249, the mileage, curiously enough, being identical, namely, 1,144, and the average cost per mile was £2,982. The total difference in cost and in favour of the present system of construction by day labour amounts to no less than £2,078,471 for the period named. With the help of these figures, it will be perfectly clear that the Railway Department in Queensland have acted with considerable wisdom, and have effected enormous economy in constructing lines by day labour and equipping themselves with a complete and up-to-date contractors outfit, which they are able to keep in constant employment, and shift about as needed, so that the equipment may be available just when and where it is most wanted, and be operated with the

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greatest possible economy and success. Labour-saving appliances now in almost constant use by the Railway Department are the following:—Earth ploughs, stump-jump ploughs, graders, delvers, wheel scoops, drag scoops, flat-topped trains with side delivery ploughs for discharging earth direct from cars, spreaders working in conjunction with flat-topped trains, light portable rails and steel side-tipping trucks, air rock-drills, concrete mixers, Priestman's grabs, oil engines, motor cars, traction engines with wagons, forest devils, steam shovels or navvies, hopper wagons and ballast ploughs, track lifters, steam rail benders, rail benders of various kinds actuated by hand, track drills, and electric exploders.

To resist the pressure brought to bear upon successive Ministries, the Government, in 1906, passed an Act making inhabitants of a district through which any new railway is to pass liable to contribute to the cost of working the railway, if it is found upon completion to be unremunerative. Under the operation of this Act, when the construction of a new railway is proposed, a trial survey of the track is made, and a plan and section prepared showing the area which would be benefited by the construction of the line, together with an estimate of the cost. The Commissioner for Railways reports to Parliament upon the proposal, recommending or otherwise the construction of the line, and stating what he estimates the revenue and expenditure are likely to be. If the recommendation be favourable and the project approved by Parliament, all the residents within the area shown upon

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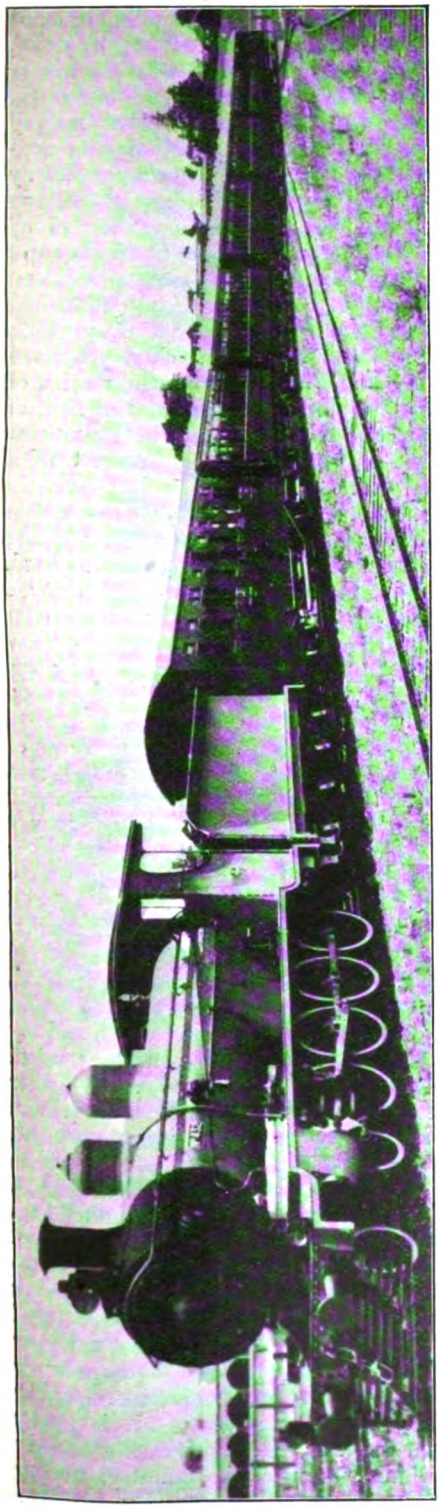

LATEST TYPE OF LOCOMOTIVE AND ROLLING STOCK: QUEENSLAND RAILWAYS.

the map as benefited by the railway (provided they also approve the construction of the line) automatically become parties to a guarantee that the line shall yield 3 per cent. net revenue on the certified cost of construction and working. If the railway does not yield this amount to the State, the Commissioner has power to recover the deficiency from the residents within the benefited area, and may levy a tax upon them for this purpose.

This guarantee of a net 3 per cent. income remains in operation until the line earns 3 per cent., or over, for three consecutive years, whereupon the guarantee lapses. The Government have found from experience that they may safely accept the attainment of this position as sufficient evidence of the railway having become remunerative and the inhabitants of the benefited area are thereupon released from this liability. The success of this provision in checking the demand for the construction of unprofitable railways is best evidenced by the fact that in only two or three instances has it been necessary for the Railway Commissioner to exercise his rights and collect deficiencies from the inhabitants of specific benefited areas. Such demands have, however, been made by the Commissioners and have been paid by the ratepayers concerned. Provision is made in the Act for consulting, before the construction of a railway is commenced, the inhabitants of any benefited area who would, by the provisions of the overriding 3 per cent. guarantee Act, be made liable for such contributions, and they may veto the proposal if a two-thirds majority are opposed to its construction. But in particular cases—such as the construction of the Great Western Railway, about 1,300 miles in length—the several districts through which the line would pass were massed together, and regarded as one field. The existing railways in every case start from some important centre on the coast, and run generally in a westward direction.

Parliament has authorised the construction of a Great Western Railway, which is shown upon the map as running parallel to, but at considerable distance (varying from three to five hundred miles) inland from the coast. The railway will connect up the several railways which run across the State almost directly inland from the several important cities and towns on the coast—the eastern termini being, in nearly every case, on a wharf alongside which the

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big oversea steamers load and discharge. The Great Western Railway will start from the southern end of the State at a point on the Brisbane railway about 500 miles inland from Brisbane, and run in a north-north-west direction towards the Gulf of Carpentaria. Whether the northern end of this railway will connect with the seaboard on the north coast of Queensland, or whether it will go through to Port Darwen, in the northern territory of South Australia, is still uncertain; but the completion of such a railway will be an enormous advantage to the State in a variety of ways. It will, for the first time, link up all the existing railways, and make the rolling stock available for any part of the system where it may be at any given time greatly needed. This will greatly increase the facilities available for removal of stock in time of drought, so that flocks and herds may be readily transported from any portion of the State, which happens in any year to be short of food and water, to some other more favoured district where they might find sustenance, and to which, at the present moment there are no means of conveying them with sufficient promptitude or in sufficient numbers, as the rolling stock on each of the existing but quite detached lines is, generally speaking, only sufficient for normal traffic requirements.

The completion of this railway, and the extension of the utilisation of the artesian and sub-artesian water system in Queensland, will enormously decrease the losses which have been suffered in previous years of drought. The strategic value of such a line of railway could not easily be overestimated if Queensland should have at any time to deal with enemies bent on attacking her coastal cities. It would link up all her ports with the heart of the Commonwealth military system, and by a line too remote from the coast, for almost the whole of its length, to be in any way exposed to hostile interference, and would transport her defenders safely and speedily to that portion of the Commonwealth which, in the opinion of many, is most exposed to attack. The Government are also now engaged in the construction of a coastal railway, running parallel to, and comparatively close to, the sea coast, and will prolong the coastal railway (which now extends from Brisbane as far north as Rockhampton) a further distance of about 600 miles, linking up in its course all the coastal cities and towns as far north as Cairns. There are several short lengths of railway in the neighbourhood of Townsville, Cairns, and other places, which will be utilised as far as possible so as to avoid any duplication of the track. The greater part of this coastal railway will run through exceedingly fertile agricultural land lying beyond the areas already served by means of local transport facilities which exist in the neighbourhood of all the principal towns, open up millions of acres of land suitable for close settlement, dairy farming and similar pursuits, and afford facilities for transport of produce, not only to the more thickly populated portions of the State, but to the market of the Old World, by means of the fleet of refrigerating steamers trading between Great Britain and Queensland, *via* Torres Straits. Better mail communication between the more northern ports of the Colony and the southern States and Great Britain will also be assured when this railway is completed. The mails are in the meantime carried to the northern parts by the regular mail steamers which connect with the existing railway system at Gladstone, and carry the mails from that port to all the northern portions of the State.

With regard to further developments of the Queensland railway system, Sir Thomas Robinson stated that the necessity for still further increasing the railways in the southern district is, perhaps, nowhere better demonstrated than in that portion of the State which lies within easy range of, and parallel to, the New South Wales border. In that portion of the State there are already existing, and in profitable operation, two almost parallel lines of railway about 150 miles apart. It has been found by experience that, for dairying purposes, cream cannot safely be carried by road farther than about 25 miles, and, in consequence, a railway line serves, for dairying purposes, about 50 miles of country, *i.e.*, 25 miles on each side of the track. Almost the whole of the land between these two existing lines of railway is still the property of the State, is at present very largely utilised for sheep grazing purposes, and is held by present occupiers on short leases. The character of the soil generally resembles very closely that of the Darling Downs, being eminently suitable for closer settlement, and especially for the dairying industry. It is clearly evident that, if two other lines of railway were built through this country, running approximately east and west, connecting on

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the east with the existing lines and so giving communication with the coast, the land would be increased in value, on an average, by fully 30s. to £2 per acre. It has been shown by the Government officials that if the land were sold at, say, £1 per acre over its present value, the additional sum realised would be more than sufficient to cover the cost of the railways, and, in the opinion of some, would pay the cost twice over. There can be no doubt that if this proposition were in private hands, the money would be promptly raised to construct these railways, because of the enhanced value of the land, which would then become immediately marketable on account of its rich character and railway facilities, and the payable continuous traffic available for railway revenue.

so many quarters, with such urgency and such good reason, that it is greatly to the credit of the Queensland Government they continue to progress with the utmost caution and deliberation. Having contrasted the operation in Queensland of the policy of allowing railway construction to follow the settlement of the land and in Canada of railway building to open up settlement, the Agent-General continued :—

The proposed railways will open up enormous areas of the most fertile lands, suitable for close settlement and profitable cultivation, so that conditions which are expected to benefit the shareholders in Canadian railways so handsomely will operate in exactly the same way in Queensland, but in Queensland the benefit will be to the State rather than to the individual. It

CENTRAL STATION, BRISBANE: QUEENSLAND RAILWAYS.

In the north and in the central districts extensive coal deposits, having in some cases seams of coal 12 ft. and, in others 60 ft. in thickness, have been proved and developed within 16 and, in other cases, 30 miles of the existing railways. In more than one case there is an urgent demand for the coal at the inland end of the line for smelting purposes, and at the seaboard end for sugar and other manufacturing purposes, bunkers for steamers, and the like. Here, again, there is an urgent necessity for further extension of the Queensland railway system, and fortunately in most cases through comparatively easy country. Demand for railway extension upon perfectly sound commercial lines comes from

must have been exceedingly difficult for those entrusted with the planning of the principal cities and towns in Queensland to realise, in the very early days of the State's existence, the development and extension of the railway system which will be necessary to cope with the ever-increasing railway traffic. In making inadequate provision for railway purposes Queensland has only repeated similar mistakes which have been made in the past by both Victoria and New South Wales. Within the last few years, in Melbourne and Sydney, as well as in Brisbane, the termini of the State system of railways have had to be extended and enlarged very considerably, as the traffic has completely outgrown the accommodation and space available.

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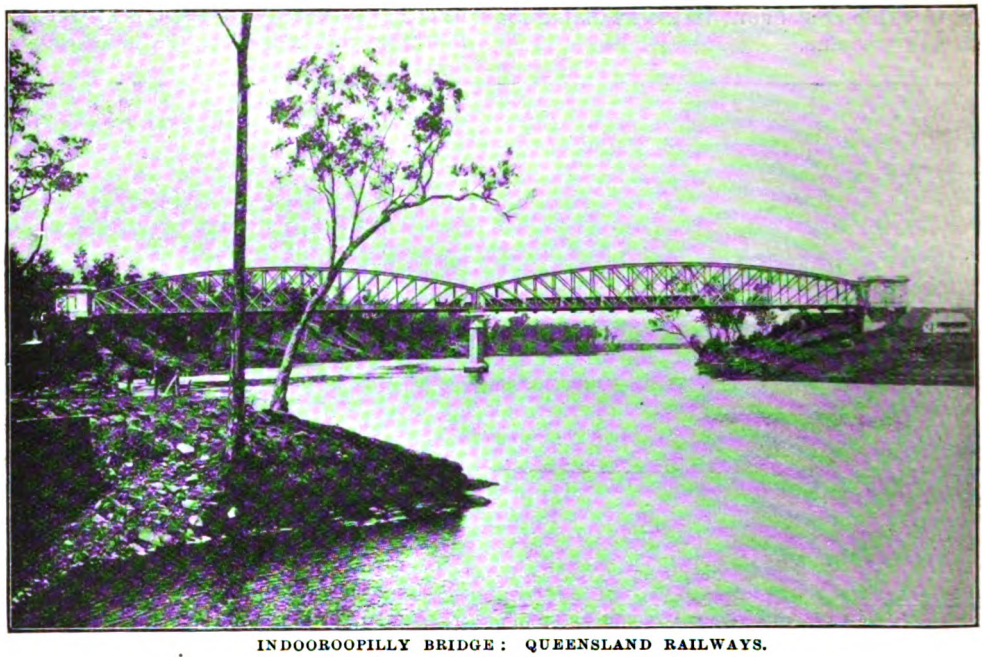
The lighter engines and rolling stock of the early days ran upon lighter sections of rails. Heavier rolling stock and the greatly increased weight and power of engines has necessitated the re-laying of much of the permanent way with a far heavier section of steel rails, and in order to meet the demand of the constantly-increasing traffic the use of the heavier rail is steadily extending from one end of the State to the other. The development and gradual perfection of both locomotives and carriages on the Queensland railways is very remarkable. Improvement in design has made it possible to obtain greater comfort and convenience for passengers simultaneously with a very marked decrease in the weight of the rolling stock, and, in consequence, in the cost of haulage and wear and tear of permanent way. The relative weights and capacity for passenger accommodation in the respective trains shows the improvement which has been made of late in both directions. The gradual evolution of the superior type of locomotive and carriage now superseding the older type of trains in Queensland must be credited to the Government engineers, and the carrying out of their designs to the railway workshops at Ipswich.

While the type and design of the latter-day locomotive is evolved and perfected at the Ipswich workshops, the duplication and manufacture of the locomotives, when once the design has been settled, is now generally entrusted to private manufacturing establishments within the State. This has been found essential in order to obtain locomotives in numbers with sufficient promptitude to enable the Department to cope with the rapid development of traffic. But while advantageous to entrust the construction of most of the locomotives to private firms, it has been found more advisable to continue to construct almost the whole of the passenger carriages and rolling stock, apart from locomotives, in the Government workshops at Ipswich.

The interest taken by the Government in the comfort and welfare of the workmen in their employment is perhaps scarcely understood, and certainly not equalled upon this side, and although the arrangements for the economical supply of good food to workmen at the Ipswich shops cannot be said, as yet, to be quite equal to those obtaining at works like Messrs. Krupps, at Essen, for instance, the Railway Department of Queensland places at the disposal of their workmen comfort and conveniences with regard to food, whether supplied by the works or sent in to them from their homes during working hours, the like of which exists in but very few establishments of a similar nature in this country.



INDOOROOPILLY BRIDGE: QUEENSLAND RAILWAYS.

The Railway Department have recently erected within the works, for the use and convenience of their employes, a dining-room, which measures 100 ft. by 72 ft. Adjoining

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is a kitchen 36 ft. square, and, on the other hand, a reading and smoking room, also 36 ft. square, besides commodious stores, pantries, etc., and around the outside of nearly the whole building is a 10 ft. wide verandah. The Commissioner for Railways has provided all the necessary cooking utensils and equipment, such as cutlery crockery, chairs, tables and furniture, free of charge to the men, and has left them to make their own arrangements with regard to catering. A committee appointed to manage the rooms engage the services of a caterer, who undertakes to provide five dinners per week for the sum of 1s. 9d. This furnishes eloquent testimony of the cheapness of the essentials of good living in Queensland. Of course, the amount appears to be very small in comparison with what the same would cost in Great-Britain; but it must be remembered that the caterer has the rooms free of charge, that he has no municipal or water rates to pay, that fuel and lighting are free, and that the Government provide a sufficient supply of ice to enable the provisions to be brought in wholesale quantities, and kept in fresh condition until they are withdrawn from store for consumption. When the men enter the rooms at dinner time, a plate of soup (which is the first course on the menu) is ready for them, while the next course is cut and being kept hot in the kitchen. To enable the caterer to do this, to-morrow's menu is placed before each man to-day, and a note is made of his number and his to-morrow's order. By this means not only is each man's meal ready for him when he enters the room, but the caterer knows exactly how many plates of each dish he has to provide. Some of the men bring their own dinners and for these the Department supplies "billy cans," each with the man's own number; and all he has to do is to bring his tea to the caterer, who takes care that when the whistle blows his billy of tea is ready and waiting for him. The cost of erection and equipment of these rooms amounted to between £2,700 and £3,000, but in the opinion of the men, and of the public, the money has been well and wisely expended.

Sir Thomas Robinson concluded his valuable and instructive paper with a description of the wonderful scenery through which the trains pass over the railways of Queensland, and of the engineering difficulties encountered upon some of the tracks. As instancing the development of the railway traffic at Rockhampton, he stated that when he was resident in Rockhampton twenty or thirty years ago they used to have three passenger up trains and three down trains per week, but in December last, when he was again in Rockhampton, the traffic manager told him that he had passed no less than 90 trains over one set of points and crossings at that station within twenty-four hours. Among other slides exhibited was one of the Barron Falls, which the railway passes just before reaching Kuranda station; a series illustrating transport in parts where railways do not yet exist; and finally a group of views representing incidents witnessed on one occasion when Mr. Evans, the Railway Commissioner, and some of his staff were on the way to Winton, to complete surveys and settle routes for a portion of the Great Western Railway. The party were overtaken by a downpour of rain, and for three weeks it was impossible to send him any assistance, or to replenish his supply of food. Communication was impossible, and his whereabouts unknown; and the public were eventually greatly relieved when it was known that he had reached his destination in safety.

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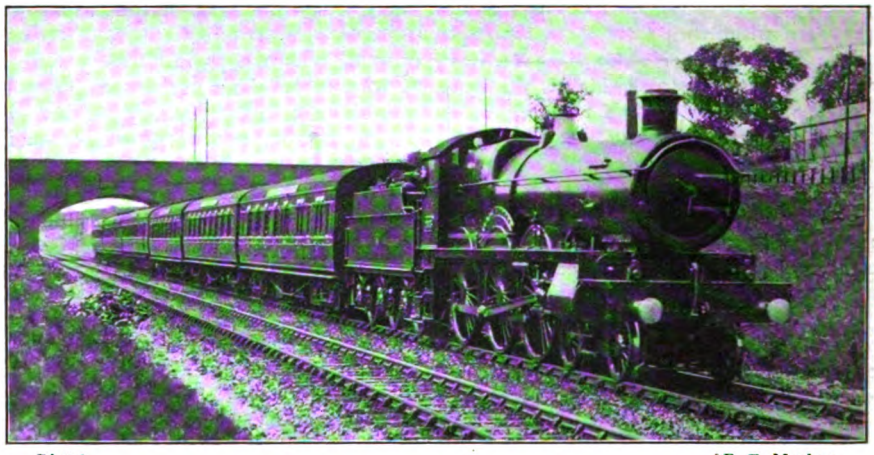
Modern British Restaurant Car Services.

[No. II.]

By "VOYAGEUR."

A PRACTICE that has come somewhat into prominence lately is the service of light refreshments, in connection with which a much reduced kitchen accommodation is obviously required. The latest convert to this idea is the London and North Western Railway, which has equipped "tea-cars" on the 2.30 and 4.45 p.m. expresses from Euston to Birmingham, the 3.40 and 5.0 p.m. trains from Birmingham to Euston, the 4.5 p.m. Euston to Manchester the 2.40 p.m. Euston to Liverpool, and the 2 p.m. Liverpool to Euston. In all these cases (save the 4.45 p.m. down and 5 p.m. up "Birminghams") the tea-car consists of an ordinary coach from which two compartments have been removed to form a kitchen. Teas and light refreshments are served from this vehicle as required.

Another recent convert is the Lancashire and Yorkshire Railway, which has installed a "tea-car" on one of the principal residential expresses between Manchester and Blackpool. The same practice is also in force on certain Great Western expresses, *e.g.*, the 2.35 p.m. Paddington to Shrewsbury, the 3.15 p.m. Paddington to Cheltenham, the 4.45 p.m. Paddington to Wolverhampton and the 3.5 p.m. Cardiff to Paddington. Certain trains on which the accommodation used to be of this character, as the 3.30 p.m. from Paddington to Plymouth, and the 3.35 p.m. to Swansea, are now equipped with restaurant cars of the ordinary pattern. On the Midland Railway for some years a similar type of vehicle has been in use, containing a kitchen of fair size and five compartments or more; but in this case the equipment is sufficient for the service of *table d'hôte* meals on a small scale, more particularly breakfasts and luncheons. In the latter case chops and steaks are served in place of a joint. Among the trains on which these cars were to be found are the 4.50 a.m., 10.5 a.m. and 2.30 p.m. London to Manchester, which, as will be seen, include the hours of breakfast, luncheon and tea. In the latter two instances, however, the growth of the business thus instituted has led to the provision of standard restaurant cars within recent months, thus proving the value of the tea car in "working up" restaurant custom at small expense. A point which considerably favours the



Photo] [*F. E. Mackay.*

GREAT WESTERN RAILWAY:

Two-hour Birmingham Restaurant Car Express. Locomotive No. 2903, *Lady of Lyons.*

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tea-car is that, when the service of meals is not required, the kitchens may be locked, and the cars economically employed as ordinary passenger coaches. The arrangements on the Great Central line have already been mentioned; the meals are almost entirely of the *a la carte* order.

The particular type of seating accommodation adopted on different lines also varies considerably. Except in the case of the North British Railway, the majority of Great Central Railway cars, and a few of those on the Midland Railway, virtually all the restaurant coaches running are, as I have shown, of the open type. In these the seats are generally arranged to accommodate two on one side of the gangway, and one on the other—that is, tables for four on one side, and for two on the other. In nearly the whole of the first-class cars on the Great Northern, and East Coast Joint service, however, the tables on both sides of the gangway are single, allowing for roomy seats and wide vestibules. A novelty is found in these cars in the provision of large seats of the armchair type, which afford exceptional comfort to the traveller, while the seating in many of the third-class cars is also decidedly novel, tip-up seats being employed, so that the seating accommodation may be clearly numbered and defined. On the "Norfolk Coast Express" of the Great Eastern Railway, as the starts from either end are comparatively late for luncheon (1 p.m. and 1.30 p.m.) arrangements had to be made to accommodate the maximum number of passengers possible at one sitting.

Consequently the third-class cars are arranged with double tables on either side of the gangway, so that accommodation is thus made at one sitting for no fewer than 72 third-class passengers and 36 first-class passengers—total 108. As a large number of these are usually children, in family parties, the "fit" at the tables is not always so tight as might be imagined, although it may be noticed that the practice of seating four passengers abreast has not been repeated in the more recent cars constructed by the Great Eastern Company. In providing loose tables and chairs, after the ordinary fashion of a dining room, the Great Western Railway departs from our insular customs, and copies the usual pattern of cars on the Continent and in America. The same principle is in vogue on certain of the West Coast Joint cars, and also on the special London and North Western Railway American Boat trains. The provision of these small dining-room chairs in place of the ordinary high-backed seats generally allows of more people being accommodated in the same space.

Photo] [*F. E. Mackay.*

GREAT EASTERN RAILWAY:
Up Cromer Restaurant Car Express. Locomotive No. 1824.

In the matter of tariff, considerable variations may also be noticed. The average prices charged are somewhat as follows: Breakfast costs half-a-crown, and includes porridge, fish, bacon and eggs or some corresponding dish, with tea or coffee, toast, bread, butter, marmalade or jam. Lunch, at the same figure, covers soup, fish, joint or *entrée* with vegetables, sweets, bread, cheese, butter and salad. Both classes of passenger are charged at the same figure for these meals. The third-class dinner costs the same as the lunch, and includes

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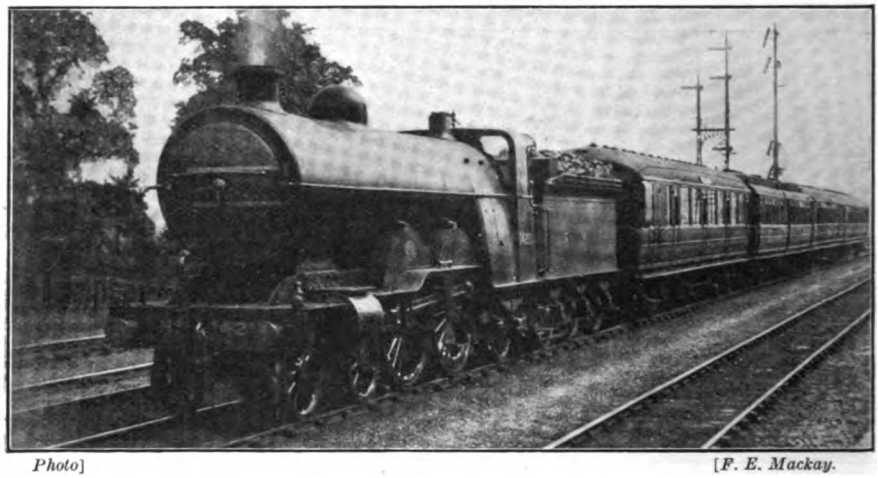
the same items: but the first-class, with an extra course of poultry, and dessert, costs 3s. 6d. On most lines the first-class dinner may be taken in the third-class car on payment of the additional shilling, which simply means that exactly the same food is served, plus the additional courses.

It is a fact of which a good many people are apparently ignorant that, generally speaking, the food served to the passengers in both first and third-class cars is identical, so that the third-class traveller who in busy holiday times, has been accommodated in the first-class car, and thinks to have accomplished a wonderful stroke of business by securing the "first-class lunch" at the same price as he would have paid at the other end, has really nothing beyond the additional comfort of the seat upon which he can congratulate himself. Afternoon teas are usually obtainable on every line at all times when *table d'hôte* meals are not being served, a small pot of tea with bread and butter costing sixpence. On account of its cheapness and refreshing character, this is, of course, the most popular of all the meals served, and the teas supplied on well-filled expresses often run into hundreds in a day. On lines using the single type of restaurant car, such as the Great Western, teas are served at stated times, similarly to other meals, the car being usually opened for an hour during which the passengers pass in and out to tea as desired.

There are, of course, a number of variations from the tariffs mentioned. The first-class breakfast on the London and North Western and West Coast Joint cars costs three shillings, with an extra course added, the third-class dinner being fixed at the same price. On the Midland the third-class dinner also costs three shillings, but it includes poultry, and the dinners, which always attain to the level of artistic daintiness associated with "things Midland," generally include *hors d'œuvres* or a savoury, and frequently in the summer ices as well. Several other lines also make a practice of serving *hors d'œuvres* or a savoury, generally with the dinners, particularly the London and North Western, Great Northern and East and West Coast Joint services. On the Great Northern and East Coast Joint cars, soup is generally omitted from the summer lunch *ménus*. On the London and North Western or West Coast Joint cars the passenger is allowed at lunch to partake of an extra course of cold meat with salad, if he wish.

A novelty much appreciated on the Great Western and London and South Western lines is that of allowing first or third-class passengers to take the 2s. 6d. or 3s. 6d. dinner at will, the practice with the former line being to reserve different sets of tables in the car for the two meals. The type of tea obtainable also varies considerably on different lines, the London and North Western, West Coast Joint and Great Eastern Companies' service of teas



Photo] [*F. E. Mackay.*

GREAT NORTHERN RAILWAY:

Down Leeds and Bradford Restaurant Car Express. Locomotive No. 1422.

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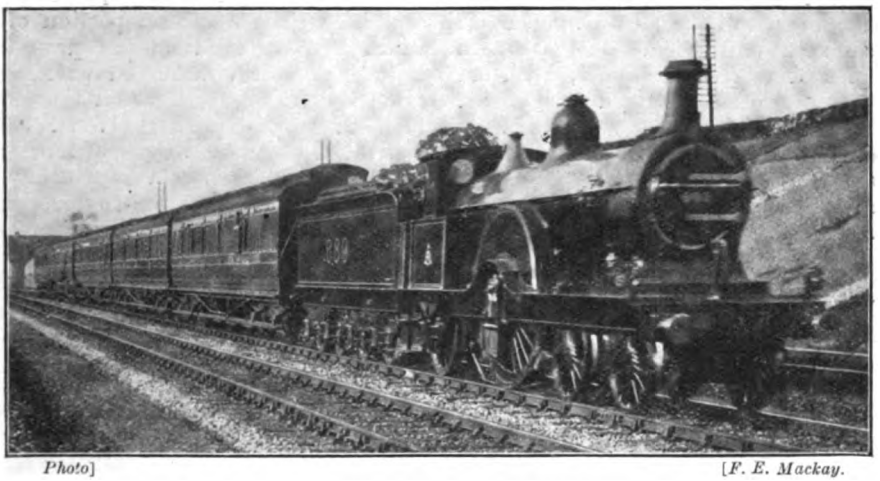
being noteworthy on account of the varied appetizing viands to be obtained at a very moderate figure. In this country the Pullman car tariffs are altogether above the ordinary British level, a pot of tea with bread and butter, for instance, costing a shilling, and with toast the somewhat exorbitant sum of eighteenpence. For a cold lunch, also, three shillings seems a somewhat unnecessarily high price to charge. But people who use these cars appear to make little complaint on this score. On each tariff, wines, spirits, mineral waters and coffee are always additional to the fixed price of the meals. For the purposes of sale all the cars, of course, require to be licensed, and the license is usually taken out in the name of the hotels manager. On the new cars in the Continental services of the South Eastern and Chatham Railway the catering is entrusted to the International Sleeping Car Company.

As regards *a la carte* meals, on most of the lines running the "open" type of car a grilled chop, steak or other dish of like character, may be obtained at such times as *table d'hôte* meals are not being served. The price of a chop or steak with vegetables, sweets, bread, butter, cheese and salad, varies from two to three shillings. The principal lines encouraging *a la carte* service are, however, the Great Central and the Great Eastern Railways, on both of which lines exceptionally moderate tariffs are in force. On the Great Central, for instance, a grilled chop or steak, with bread, butter and cheese, may be obtained for eighteenpence, a plain breakfast with boiled eggs and marmalade for the same price, breakfast with fish and bacon and eggs for two shillings, a bowl of soup with bread for sixpence, with other items at equally reasonable prices.

Similar charges prevail on the Great Eastern Railway. The most revolutionary of all the restaurant car tariffs in this country is, however, that in force on the Southend service of that company, where a special effort was made to secure the patronage of residents for the new service inaugurated in 1911. On these trains the meals served are principally breakfasts, teas and suppers, and the tariff includes a list of the most varied dishes, both light and substantial, at hitherto unheard-of prices. For instance, a breakfast on the train, consisting of a pot of tea or coffee, two boiled eggs, with bread, butter and marmalade *ad libitum*, may be had at one shilling; a grilled steak at the same price; two poached eggs on toast at sixpence; or a cup of tea at twopence—prices literally lower than those in many restaurants with a service considerably superior and much more dainty. Such charges bear witness to a greater revolution in railway catering than has been experienced since the restaurant car was introduced. On the same company's "Norfolk Coast Express," too, some decided novelties may be witnessed, such as the purveying of ices (a somewhat thankless task during the past "summer,"



Photo] [F. E. Mackay.

MIDLAND RAILWAY:
Up Manchester Restaurant Car Express. Locomotive No. 689.

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one would imagine), fruit, sweets and cups of tea up and down the train. The advertisement of "feeding bottles for infants" on the tariff also strikes the observer as decidedly enterprising! Not only so, but the cars in these cases certainly merit the more attractive and popular title of "Restaurant Car," which has always been standard on the Great Eastern Railway, instead of the somewhat exclusive "Dining Saloon" so frequently met with elsewhere.

In continuing this general survey of restaurant car services, a few notes on the actual culinary side will no doubt be welcomed by readers. It is impossible here to describe the kitchens of all cars in use, which are more varied in character and arrangements even than the passenger portions of the cars. In the early days the cooking had all to be carried out with coal fires in a kitchen of the most confined size and insufficient ventilation. But gas ranges of large and convenient types, with an ample supply of compressed gas stored under the vehicle, have now superseded the original methods, while the whole tendency of modern construction has progressed in favour of more commodious kitchen accommodation and improved methods of ventilating both kitchens and cars.

The kitchen staff consists of a *chef* and a kitchen porter, together with an assistant *chef* if a large amount of work has to be performed. For serving the meals, also, the number of attendants varies from two on single cars to as many as six on cars in sets of two or three—three to serve in the first-class and three in the third. It will be noticed that restaurant car attendants are usually of a good class socially, it being essential to employ polite and well-spoken men for the purpose. The pay is not by any means extravagant, but a fair sum can be made out of tips, especially on the more popular trains. The careful system of "profit sharing" instituted on many cars by the *employés* themselves ensures the general *esprit de corps* among the staff that contributes so much to the success of the catering.

With regard to the dimensions of standard restaurant car kitchens I may state that among the most commodious cars, from the culinary point of view, in present use are the joint Great Northern and North Eastern type used on the London and Newcastle services. In this vehicle the kitchen is 15 ft. long, and the pantry 12 ft. 6 in. long, the width in each case being 6 ft. In addition, the attendants are furnished with a compartment 5 ft. by 6 ft. for their own use, as well as with a small toilet compartment. That is to say, 35 ft. 7 in. of the total length of the car are given over to cooking and serving operations, against 25 ft. 9 in. of seating accommodation! But the car is, of course, flanked by open cars with tables on either side, to supplement this limited seating.

The latest composite North Eastern cars are also very commodious, having open kitchens no less than 21 ft. long, together with pantries 5 ft. long. The largest type of Great Central restaurant car has a kitchen and pantry combined, 20 ft. 3 in. long by 5 ft. 9 in. broad. The Great Eastern Railway also equips modern cars with kitchens of large size, those in the older cars having been also considerably extended, more especially since a certain portion of their width was curtailed on the provision of a through corridor. As an example, the kitchen of the central car on the Hook of Holland boat express is 17 ft. long by 6 ft. 6 in. broad, and those of more recent cars are still larger. On lines using single cars the kitchens are, of course, smaller. The modern Great Western car, for instance, has a kitchen 12 ft. 9 in. long by 6 ft. wide. A similar car on the London and North Western Railway has a kitchen 10 ft. 8 in. by 6 ft. 5 in., and a butler's pantry of the same width, 8 ft. long.

In the design of the kitchen everything must be so arranged as to be ready to hand when required, and yet to occupy the minimum of space, consequently the arrangement of ranges, refrigerators, cupboards, racks, and all the other multifarious features of equipment displays marvellous ingenuity. Allowance must be made for the occasional unsteadiness of the coach in riding, and the crockery must therefore be stored in such a way as to ensure no danger of breakages if the car should give a sudden lurch on a curve, or elsewhere. Plates are usually stored flat in vertical racks, into which they are inserted from the top, and as easily and quickly withdrawn for use. Cups are now generally stored in a kind of slide, arranged transversely, instead of by the old method of hanging from the ceiling. Various designs of cups, by the way, have been introduced to minimise the spilling of liquid through the oscillation of the train. The most successful device is that of the Great Central Railway, whose cups taper inwards toward the top. London and North

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Western and West Coast Joint cups are furnished with a lip all round, which certainly saves a good deal of spilling.

Breakfasts are cooked entirely on the trains, while the service of teas is an equally simple matter. For luncheons and dinners, soups and pastry are generally put on board ready made, requiring only re-heating before serving. Fish, joints and poultry, however, are nearly always cooked entirely in the car, save only when a meal is to be served immediately after starting, when they are sometimes brought on board the train at the starting station ready for immediate "dishing up." These supplies are secured from the railway hotels at the various terminal stations where this practice is in vogue, except in the case of the London and North Western and Great Northern Company, who have established special restaurant car kitchens in the stations for the purpose of thus supplying the cars.

In these depôts, as well as in the terminal hotels of the railways which have not provided special depôts of this character, are kept the necessary stores of grocery, stores and linen required for the maintenance of the services. In addition, several of the large companies go so far as to carry out all their own baking for both restaurant cars, refreshment rooms and hotels. The Great Eastern Railway, for instance, bakes the whole of its own bread and pastry at Liverpool Street Hotel; the London and North Western Railway does the same at Rugby, and the Great Northern Railway at Peterborough.

GREAT NORTHERN RAILWAY:
Special restaurant car, supplied with oval tables and arm chairs.

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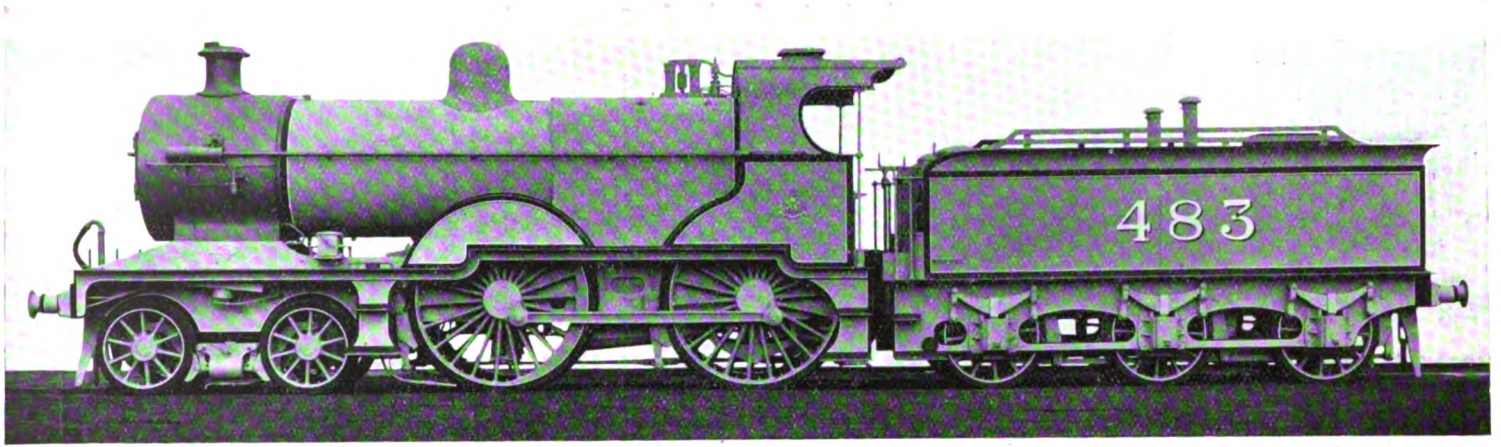
Rebuilt Locomotive (with Schmidt Superheater): Midland Railway.



By the courtesy of Mr. H. Fowler, Chief Mechanical Engineer, Midland Railway, we are able to illustrate one of the series of 4–4–0 locomotives recently rebuilt (some of them for the second time) and fitted with Schmidt superheaters, piston valves, Anderson by-pass valve, mechanical lubricator, and enlarged smoke-box. Among other changes may be noted an alteration to the splashers, brake gear to the bogie wheels, and fluted coupling rods.

LEADING DIMENSIONS:

Cylinders: 20½ in. by 26 in.	Heating surface—tubes: 1,045 sq. ft.
Coupled wheels: 7 ft. 0½ in. diam.	firebox: 127 sq. ft.
Steam pressure: 160 lbs. per sq. in.	superheater: 313 sq. ft.
Grate area: 21·1 sq. ft.	total: 1,485 sq. ft.

Weight of engine in working order: 53 tons 7 cwt. With tender (loaded): 93 tons 4 cwt.

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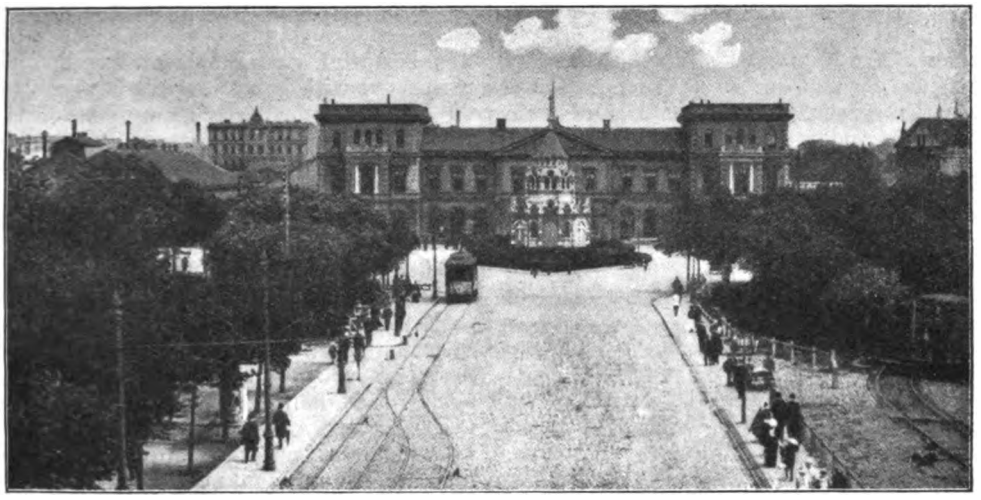

THE DÜNA RAILWAY STATION AT RIGA.

Leaves from the Log of a Locomotive Engineer.

[No. VII.]

By ROBERT WEATHERBURN.

AFTER a short stay in St. Petersburg, I left by an evening train, having booked direct to Eydtkühnen in Poland. I found myself on the second day, still some hundred versts from my destination. Never shall I forget the terrible cold of that journey—the carriage totally destitute of warmth, the unfortunate occupants all huddled together. Icicles from our congealed breath hung from the roof, the double windows of the carriage were coated inside with half-an-inch of ice. Fortunately for us, hot tea and coffee could be had every 25 miles; otherwise the result of the journey would have been exceedingly disastrous. Before arriving at Dunaberg, our train had broken down in the neighbourhood of a station, where we were speedily transferred.

At this period, only the first class carriages were heated, and those very imperfectly. Passengers in the other classes had to rely on well-fitted double windows and doors. At Dunaberg a young Russian soldier was carried in frozen to death and one poor woman, whose after fate I was unable to learn, had her breasts frozen. The cold was intense and the thickly plumaged birds were frozen dead on the trees. During the same winter, two sledges came into Riga, the drivers sitting upright, still holding the reins of their horses, though both were dead!

Miserable, supremely miserable, was the journey, when at length we approached the frontier, and were boarded by the police to examine passports. All were in order with the exception of my own, which had not received the signature of the commandant of police in St. Petersburg, owing either to the remissness or peculation of my landlady. I was placed under police surveillance until such times as the local authorities could communicate with his Excellency. The misery and discomforts I suffered in the Jewish village of Wierbolow, I can never fully describe. Twice during the three days of my arrest, I tried to escape over the frontier and each time was taken back. Dreadfully ill, with no doctor, in a part of the Empire notorious for its Caramanjiks

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(thieves), my thoughts may better be imagined than described. At length, however, the wished for answer arrived from the Commandant and stating that I was to pass, but for this permission, I was charged five roubles. While there, I lodged with the officers of the frontier—Cossacks, whose time during the evening was passed in gambling with cards. One morning when I awoke, I found a broad tract of blood leading through my room, and, on enquiry, was informed that one of the officers who slept in a room through, and beyond my own had, in the excitement of a quarrel and struggle, broken a blood vessel. Without medical attendance, alone, with no friendly hand at his side he had died, and the incident illustrated the strange disregard for human life existing among his people.

Heartily glad to leave these scenes, I at last crossed the frontier, and entered into Polish Prussia at Eydtkühnen, a small village, but an important post—as picturesque and clean as the Russian village I had lately left was miserable and dirty. Here I resided for some months, erecting locomotives for the Moscow and Riazan Railway, and during the time availed myself of the opportunity of visiting the neighbouring battlefield in the company of a French acquaintance. It lay on what had been the broad track of the French Army when retreating from Moscow. A description of the horrors of that disastrous flight have been attempted by abler pens than mine. The field was one where the French army under the command of Marshal Ney, desperate and pursued by clouds of Cossacks, turned at bay, and inflicted a sharp defeat on their merciless enemies. It was situated about three versts from the Russian village of Wierbolow on a slightly rising plain of sand, from which the strong Siberian wind had swept its snowy covering, and converted the surface into gentle ripples. In the background stood a forest of pines and beeches, sombre and mournful in aspect. On the most elevated portion of the gently rising hill was a rude cross, upon the front of which was nailed a leaden crucifix. Rusted with long exposure to the weather, the nails allowed the crucifix to rattle with each strong gust of wind.

But here and there around lay bones, joints and vertebræ which had fallen asunder. ghastly ribs projected here and there through the sand; grim bleached skulls of the once bold and brave seemed to stare at us. The beautiful sand in places was literally permeated with bones and teeth. For over 60 years these ghastly memorials of the bloody fight had remained partially unburied. I picked up one skull which had been polished by the fine sand and bleached by the merciless winds. I thought of the philosophic Caspar, and mused "And is this all that's gained by thee, King, making victory." As I held the ghastly trophy in my hands, the wind caused a mourning sound within the deserted chambers of the mind, as if in protest against the half formed design I entertained of carrying it away. I laid it down; I could not take it—the appeal seemed so human! It was a sight never to be forgotten, and as I stood, my mind reverted to the dark days of that terrible retreat. I could imagine I saw the reeling, ragged, frostbitten soldiers, staggering, houseless and homeless, over the wide expanse of snow in a winter of unparalled severity. Clouds of Cossacks hovering around them, mercilessly cutting down the benumbed fugitives. Then a halt, a pause—the scattered remnants of the Grand Armée struggle into something like order, while their lion-hearted commander, forsaken by his Emperor, seizes the musket from the hands of a falling soldier and calls upon them to remember their murdered comrades. All this swept through my mind like a phantasmagoria. I turned away from the Golgotha. The peasant crosses himself as he avoids the field, and I felt humble in spirit, numbed at heart.

Among the Poles and others I had in my employment in Eydtkühnen was one to whom I cannot forbear making reference—a fine white-haired old man, whose face was at once a passport to favour, and an index of good qualities. I hesitated somewhat in giving him work, thinking his age unequal to the duty to be performed. But never had I reason to regret my choice. Ever attentive, ever willing, his many good qualities soon endeared him to me. I always paid him last, not out of discourtesy, but in order that I might press a few extra coppers on the old man.

One evening I said, "Well, Father Simonoffsky, you carry your years well—so upright. Why, you would even yet make a soldier; you must have taken good care of yourself, and have gone through few trials to maintain an eye so bright, a step so firm." "No, No, Sir," he answered shaking his silver grey head, "few men have gone

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through more. What would you suppose my age to be ? "

" Probably 65, Simonoffsky."

Drawing himself up to his full height, he said, " No Sir, I am 81, and few men have endured more and lived. I was a Lancer in Napoleon's Polish Legion, and came back from Moscow in the retreat."

" Then you know the battle field of Wierbolow a little way across the frontier."

" Know it ? I do. I fought there. My comrades still lie there. Have you been there, Sir ? "

" Yes," I answered.

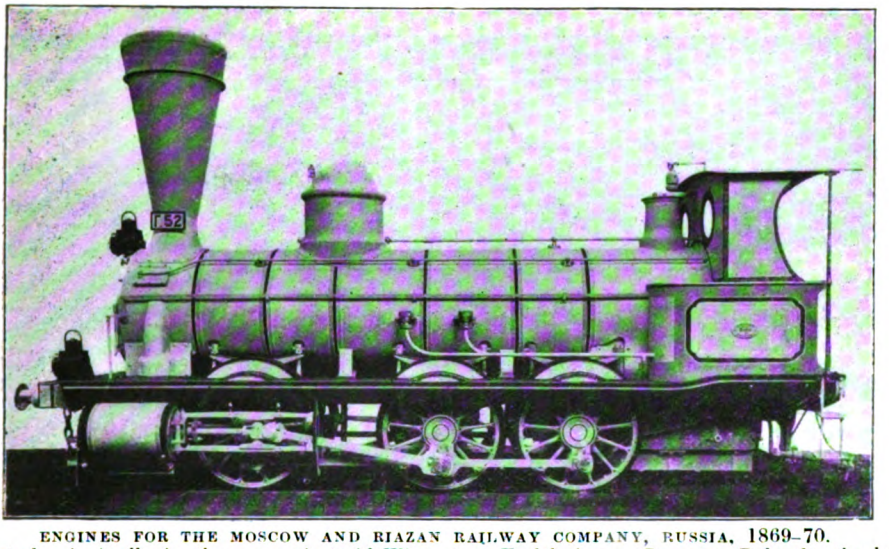
" But you did not disturb them, Sir ? You did not take anything away ? "

I knew not what to answer.

" Yes," the old man said, " I go there every Spring time, to see my comrades. They are like me," he muttered aloud to himself. " They grow whiter every year."

I had finished for the time just as the glorious Spring was setting in, the snow disappearing, leaving thousands of wild flowers exposed, with violets in profusion. The storks wandered through the village streets sacred from molestation, the children crying out " Stork, come to my house, come and build on our house." Through the avenues of trees a semi-metallic sound could be heard caused by the expanding buds flinging off their icy sheathing, and in two or three days they were in leaf. Thousands of frogs were croaking in the pools and ponds. The chilly Siberian winds had ceased blowing ; the sun was warm, and the flowers responded to his kiss.

Having finished my work, and the navigation being reopened in Riga, I removed thither—once more in the quaint old town with its stately St. Peter's spire, the highest in Russia, its Domkirch, its hospitable people, its raft and " strusen " bedecked river, and its column of victory. Associated with all this there will ever be a charm compounded of its blue skies, sombre woods, and trilling nightingales. Its winding streets and many tongued market people, its floating bridge, even its Grosse Peter with the Child Christ, and flowers and chaplets are pleasing recollections as are its feasts of flowers and fruits, its Easter



ENGINES FOR THE MOSCOW AND RIAZAN RAILWAY COMPANY, RUSSIA, 1869–70.
Erected principally in the open air (mid-Winter) at Eydtkuhnen (Prussian Poland), the last station before entering into Russia at Wierbolov, otherwise Wirballen. The contract for these locomotives was originally given to the firm of Schnieder et Cie., Creusot, France, but, owing to the outbreak of the Franco-German War, the order was taken over by Messrs. Kitson and Company, who carried out the work to the designs sent. Hence the un-English appearance. There were several peculiar and interesting features in the construction. Both injectors, although ordinarily placed, delivered through clackboxes fixed on the left side of boiler only. Smokeboxes, on either side just below the base of chimney, were fitted with sliding shutters, or plates, workable from the footplate by means of long rods steadied by brackets as shown. Although wood was the principal fuel, they were adapted to burn either coal or Lignite if required. Sliding shutters were to control the draught under conditions that seldom if ever operate here. The regulator shafts were placed exteriorily, so as to prevent waterlogged gland and sagging of rod.

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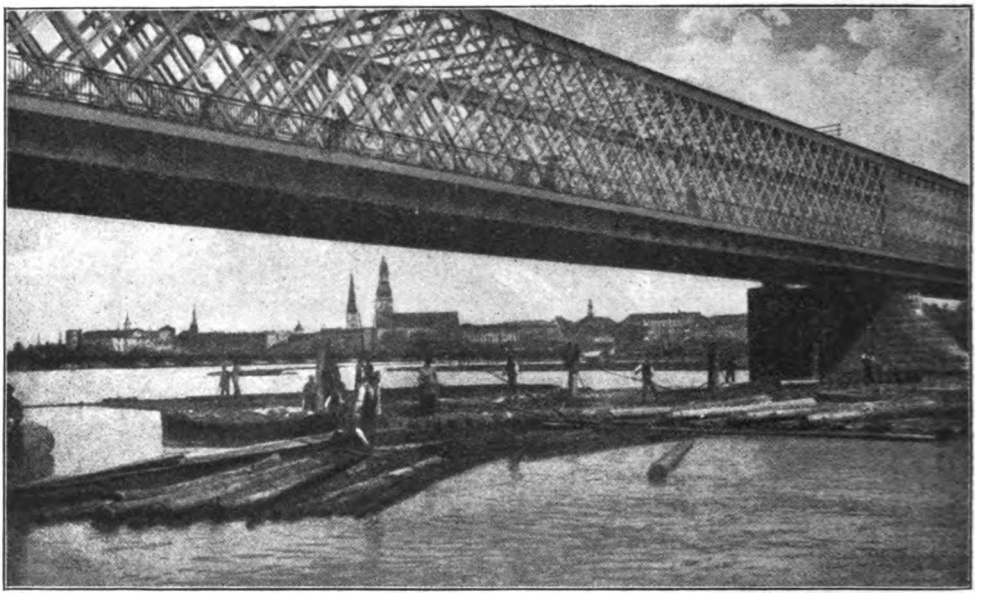
eggs and festival of Hunger Kummer, and its laden markets, where the capercailzie and wild boar, the giant elk and forest deer are often to be seen in company.

In the corner of every Russian house is an Iconast, an image of the Virgin, Christ or some miracle-working saint. No sooner does the orthodox Russian rise from his couch, than he faces toward the sacred picture before which, night and day, a little lamp is kept burning, and there he makes his matutinal devotion. Should he be a Russian Moujik or peasant, his hair, which is generally long, with each successive jerk or genuflexion is flung forward, and streams or hangs in front like a dirty mop in a gale of wind, this movement being ever accompanied by the signs of the cross on the breast and forehead. Before such an Iconast, and performing his devotions with great fervour and ceremony, was my verdolmetscher (translator) Karlovitch Ivanoff on the morning of our journey to Smolensk and Orel, where with many vows, and promises of coloured candles to his patron saint, if allowed to return in health and strength, did Karlovitch endeavour to propitiate the saint in question.

Now, there never was a more arrant rogue than this Karlovitch Ivanoff. Possessing in an eminent degree the gift of all Russians to acquire languages, he spoke four, and all were employed in the arts of dissimulation and fraud. On his bended knees I have known him protesting his innocence and truth, when he had the evidence of guilt in his pocket. None indeed knew the art of dissimulation better than did Karl. He was a peasant Prince Gortchakoff. At last we were away, each provided with pillow and bed, the journey being long. We passed by Kreutberg, sped on to Witepsk, and soon found ourselves in the forests of central Russia, sometimes seeing nothing but wood and sky for 70 and 80 versts. These are the haunts of the bear, the wolf, and the stately elk long since extinct in every other country in Europe.



RAILWAY AND FOOTBRIDGE OVER THE RIVER DUNA AT RIGA.

This bridge was under construction at the time Mr. Weatherburn was at Riga.

At last a break. The woods disappeared, giving place to a long plain wooded here and there and the towers and gilded roofs of Smolensk glimmered in the distance. Towering above all was the monument erected to commemorate the mighty battle fought there by the first Napoleon. After some slight detention, we again proceed towards Orel. The dense forest no longer skirted the track, the country was wild and open—snow, snow everywhere, for it was again winter. The villages appeared as mere heaps of snow. Its virgin whiteness, crystallised by the frost, made it wearisome to the vision. At last after 20 hours almost

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continuous riding we arrived at Orel. The railways in Russia do not always go from one large town to another. Every line is constructed for strategic purposes in war time, as well, as during peace, and to arrive at a point commanding some position is of more importance than making a slight detour of a couple of miles. Thus it happens that the town of Orel lies two versts away from the station.

Having seen all that is of interest in the town, I inquired for Werchovia, our destination, where we were about to open an experimental small gauge railway. No one knew of its whereabouts, not even the booking clerk, until I accidentally found out that it was the intended site of a village, the nucleus of which—a few houses—was already built for our accommodation. The carriage in the train I joined was occupied by the officers of a regiment in transit to the Caucasus with their families. The crying of the children, the snoring of the sleepers—for it was night—and the peevishness of the ladies, who surlily resented my inclusion made the experience very unpleasant. Each carriage was capable of holding from 80 to 100 passengers and also of providing sleeping accommodation. To illustrate the all-pervading object of the Russian Government in subordinating the whole of the railway systems to the transport of troops, I may mention that each goods wagon has painted on its sides, 40 men or 8 horses, in order that its carrying capacity may always be apparent. I arrived at 2 o'clock in my destination. It was a wilderness of a place, but I was heartily greeted by two of my friends, who had been there some weeks. They were enduring great privations, and had suffered much from frost bites, and scarcity of food, caused by interruption of supplies, consequent on heavy falls of snow, which had occasionally stopped all communications for days.

[Mr. Weatherburn's next contribution will appear in the May issue of the RAILWAY MAGAZINE.]

Photo by] [*Hellis & Sons.*

MR. A. ENTWISTLE

formerly District Traffic Manager of the London and North Western Railway at Whitehaven, has been appointed General Manager and Secretary of the Cockermouth, Keswick and Penrith Railway, in succession to Mr. D. Thompson, who has retired.

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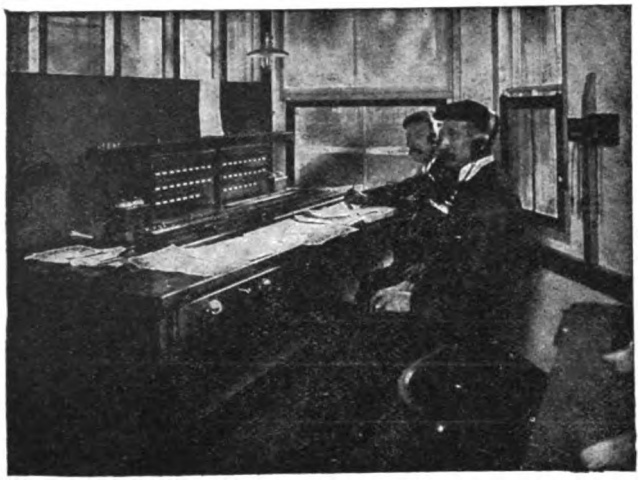

CONTROLLER'S OFFICE, SHOWING KEY CABINET.

Traffic Control on the Rhymney Railway.

MUCH attention has been given by progressive railways to improved methods of handling train movements, and in this respect the telephone has played an important part. Many railways have systems of both telegraph and telephone traffic control, but the one lately installed on the Rhymney Railway by Messrs. J. B. Saunders & Co., Limited, presents many new and important features which are worthy of particular notice. The usual practice is to connect telephones at various stations—usually signal cabins—to a common line running from the office of an official known as the "Controller," who has complete control of the traffic on a particular section of the railway line. In order that the Controller may, at will, ring-up and communicate with any signal man it has been necessary hitherto to employ what is known as "code-ringing"—a different number of rings to differentiate between one station and another. All the bells down the line ring, but the signalman attends only in answer to his own code.

In the Western Electric Company's telephone traffic control system, code ringing is entirely abolished by the employment of an ingenious device known as a "selector." A pair of wires run from the control office alongside the line, and at signal cabins and other points where the traffic is dealt with, telephones (Fig. 1) are looped across the wires. These telephones are equipped with the "Selectors." (Fig. 2.) While on duty the controller wears a head receiver and chest transmitter, which allows him to receive and to transmit telephone messages whilst leaving both hands free. In front of him is a cabinet fitted with a number of keys or switches (Fig. 3). Each key is associated with one of the signal boxes or way stations with its telephone set and selector. These keys (Fig. 4) are so arranged that when actuated they send a series of impulses along the line, the current being supplied by the battery fitted at the controller's office. The number of impulses sent out differs with each key, the keys being adjustable, so that the required number of impulses may be set.

The selector at the signal-box or way station consists essentially of an electro-magnet, fitted with an armature which actuates a small pawl, in turn rotating a small ratchet wheel. This wheel has an adjustable contact, so arranged that contact is closed after a certain number of teeth have been rotated. Each of the impulses of current sent out causes the armature of the selector to be pulled up and then released. When the armature is pulled up, it actuates a stepping pawl, and sends the ratchet wheel forward one tooth. All the selector ratchet wheels on the line operate at the same time, but as each will have the contact set at a different point after a definite number of impulses have been sent out and the ratchet wheels have come to rest, only one will have the contact closed, thus giving the ring at the required station.

By an ingenious arrangement of the electrical circuit, the ratchet wheel is locked in one direction by a retaining pawl, during the time the current impulses are on the line. This allows of the wheel

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being stepped forward, tooth by tooth, but does not permit the wheel to fall back at the time the stepping pawl returns to engage with a fresh cog. After

FIG. 1.

SELECTOR SET.

the ratchet wheel has been stepped round to the correct position, contact is made, and the bell rings. All the ratchet wheels then fall back to their normal positions, ready for a fresh call. These different movements are made with great rapidity and certainty. To get the most efficient speech transmission over the line, special telephone circuits have been devised.

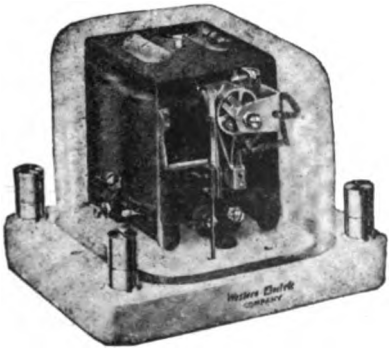

FIG. 2.

SELECTOR.

With the circuit used, as many as 40 telephones may be looped across one pair of wires, and a person speaking at one station can be perfectly clearly heard at all the others. This special telephone circuit has made it possible to provide a general call scheme which is very useful for giving daily instructions to all the way stations simultaneously. The general

FIG. 3.

SELECTOR KEY CABINET.

call scheme is arranged as follows: In addition to the contacts on the selectors described, a second contact is fitted on each. This second contact is set at the same position on all selectors, say, for example, on the fortieth tooth. An extra key fitted at the controller's office sends out in this example 40 impulses of current. When the key is operated, all the selectors step round 40 teeth, and all the contacts for a general call are made, so that the bell in each station rings. Thus the controller is able

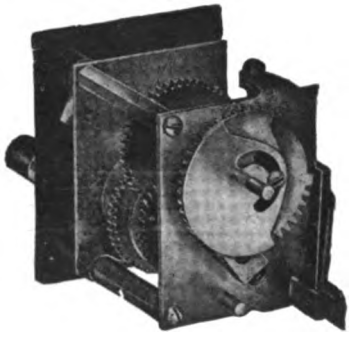

FIG. 4.

SELECTOR KEY.

to give general instructions to all stations at the same time.

When one of the way stations requires to speak to the controller, it is only necessary to remove the receiver from the hook, listen

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to ascertain if the line be already in use, and if not, to speak directly to the controller as in the ordinary way the caller always has his telephone connected across the line. In cases where the controller may not be constantly listening on the line, a magneto-bell can be fitted at his office, and the way stations supplied with a hand magneto-generator, so that they may ring up in the ordinary way. A further addition, which is usually made in connection with this system, is the fitting of a time-sending scheme. Each of the selectors is supplied with an additional contact which is "made" when the ratchet wheel has effected a complete revolution. This is used by the controller for sending out signals for the regulation of clocks, etc. By simple modifications of the circuit, the Western Electric selector system may be made to serve other useful purposes in connection with railway working. Indeed, it is claimed that this system is more adaptable to present railway methods than any other yet introduced.

Working in connection with the apparatus described, the Rhymney Railway Company have installed immediately in front of the controller a table upon which a diagram board of the whole railway is fixed, showing the Up and Down lines separately. On this board the movement of all engines and trains is from time to time recorded by the controller, as advices reach him, by the sliding of brass discs bearing the number of the particular train from position to position. When the engines are detained shunting and the like, provision is made on the diagram board at the more important junctions, stations and sidings for sliding the discs from the grooves representing the running roads into side tracks. The controller is supplied with information as each engine picks up or puts off traffic at the various junctions and sidings, and he can at any moment see the exact position of the trains working throughout the railway. He is thus able to divert engines to any particular point where traffic is waiting clearance, or to prevent them making unnecessary journeys to points where traffic which was expected is not in readiness for bringing forward.

WAY-STATION, SELECTOR SET IN SIGNAL CABIN.

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Electrification of the East London Railway.

IT was hoped that the electrification of the East London Railway would have been completed in time to allow the line to be opened to the new method of haulage at the beginning of March. Delays which were unavoidable occurred, however, in the construction of a sub-station at Deptford Road, and the inauguration of the electric service has, therefore, had to be postponed; but it is confidently anticipated that this event will take place during the present month (April). Nearly six miles in length—and running under the Thames in what was in 1843 opened as a tunnel for foot passengers—the line extends from Shoreditch, beyond which it connects with the Great Eastern Railway, to the separate stations at New Cross of the South Eastern and Chatham and the London, Brighton and South Coast systems.

Controlled by a Joint Committee, the undertaking is leased to six companies—the Great Eastern, South Eastern, London, Chatham and Dover, London, Brighton and South Coast, Metropolitan, and Metropolitan District. At the last half-yearly meeting of the proprietors, Lord Claud Hamilton, M.P., as Chairman of the Committee, acknowledged that the railway had experienced "a long and a melancholy period of stagnation." The competition of tramways accounted for a considerable diminution of its traffic, and a still greater loss occurred when, as the result of electrification the Metropolitan and Metropolitan District through services on the East London had to be abandoned. Electrification then became inevitable, and the Great Eastern Company obtained Parliamentary powers to raise the necessary capital, which was advanced at 4 per cent. interest. It was estimated that the scheme would involve an outlay of £90,000, but it is now stated that the actual expenditure does not exceed £70,000. The engineers of three of the companies—Mr. P. C. Tempest (South Eastern and Chatham), Mr. W. Willox (Metropolitan), and Mr. A. R. Cooper (Metropolitan District)—superintended the work, which is acknowledged to have been admirably carried out. Electric current will be supplied from the Lots Road generating station of the District and London Electric Railway Companies through the sub-station at Whitechapel and from a second sub-station specially erected for the purpose near Surrey Docks station. The service of electric trains is, however, to be worked by the Metropolitan Company.

There are, in the first instance at least, to be 12 passenger trains per hour in each direction—that is one up and one down every five minutes—and these will proceed alternately to the stations of the South Eastern and Brighton Companies at New Cross. Eight of the electric trains are to be local—running to and from Shoreditch, and the remaining four through trains to and from the Metropolitan Railway. In addition to this regular service, the steam locomotives of the Great Eastern Company will haul over the line several special trains devoted to passenger or horse-boxes, as well as goods trains.

It was in 1865 that the East London Railway Company purchased the Thames Tunnel, which having been begun in 1825, was, 22 years later, completed from the design of Sir Isambard Brunel. It consisted of two parallel arched passages of masonry, 14 ft. broad, 16 ft. high, and 1,200 ft. long. Great expectations as to its public usefulness were formed by the City rulers of the day, and the tunnel was opened amid a scene of more than mere local rejoicing. Guests invited on the occasion marched through the tunnel, headed by the band of the regiment then known as the Scots Fusilier Guards, and, as Lord Claud Hamilton näively narrated not long ago, "on arriving at the other end, sandwiches were provided." The genial chairman of the Great Eastern Company added that "if, in these days only sandwiches were provided, a very meagre account of the proceedings would be given in the Press"! In any case, the East London Railway is to celebrate its important transformation from steam to electricity without fuss, the present financial position of the line not appearing to justify any formal demonstration.

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0-4-0 SIDE TANK LOCOMOTIVE AT MESSRS. CADBURY BROS., LTD., WORKS.

"Bournville, No. 4."

AS makers of the famous chocolate bearing their name, Messrs. Cadbury Bros., Ltd., have acquired a world-wide reputation, but as the owners of a private railway they are not so well known. This line serves the cocoa and chocolate works at Bournville, near Birmingham, and there employed is the business-like-looking tank engine above illustrated. Built to the specification of Messrs. Cadbury's engineer, Mr. Louis Barrow, M.I.M.E., it has, after two years' strenuous work, proved particularly satisfactory. The engine is required to haul loads of 200 tons or more up a gradient of 1 in 42 and on a curve of 120 ft. radius, for which purpose it was designed with the short wheelbase of 7 ft. 6 in. It is fitted with the Walschaert valve gear, and is likewise supplied with a powerful steam brake.

The principal dimensions are as follow :—Cylinders, 16 in. diameter ; stroke, 22 in. ; coupled wheels, 3 ft. 6½ in. diameter ; boiler pressure, 175 lb. per sq. in. ; total heating surface, 836 sq. ft. ; grate area, 12.5 sq. ft. ; water capacity, 1,000 gallons ; coal capacity, 10 cwt. ; weight of engine : empty 27 tons, in full working order 34 tons. The engine is painted Midland colours, with gilt lettering.

Bournville, the well-known garden city of the Midlands, owes its creation and maintenance entirely to the enterprising company in the midst of whose great industrial establishment it stands—a model of healthy and beautiful housing for working people. Every possible advantage has there been taken of an ideal natural situation. The works, from which a world's output of a great sustaining product goes forth year after year, overlook the leafy glades and meandering brook of a delightful park ; the houses provided for every class of employés are splendid specimens of domestic architecture ; the places of worship, the public hall and library, and the many other educational or recreative agencies—all contribute to make Bournville a centre of which everyone who knows it is justly proud.

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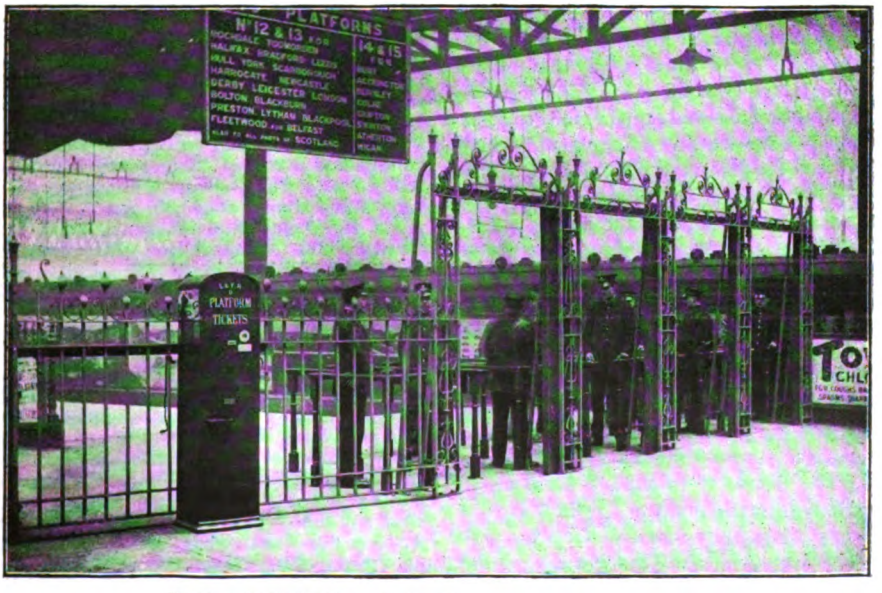
Improvements at Victoria Station, Manchester.

AN innovation of considerable advantage to travellers in Lancashire and Yorkshire has been introduced at Victoria Station, Manchester. In connection with recent extensive structural alterations which have been made, the Lancashire and Yorkshire Railway Company now conduct the station as an enclosed property. This means that all Manchester tickets are collected at Victoria after passengers have there detrained, instead, as hitherto, at Salford, Middleton Junction, Rochdale and other stations outside Manchester. A considerable saving of time is thereby effected. By far the greater number of trains now entering arrive some minutes earlier than formerly. During the summer months when the tourist and excursion traffic is very heavy, delays of ten minutes sometimes occurred while tickets were being collected. The elimination of such delays, which reacted on other trains and caused congestion, will be a great boon to travellers.

An advantage of probably greater importance to the travelling public has been gained by the further decision of the Company to make, to all persons who do not hold a travelling ticket, a charge of one penny for admission to the platforms. The annoyance caused by crowds of sightseers, who have previously congregated on the platforms, making them a happy hunting-ground for the pickpocket and luggage thief, is thereby checked. This policy, long ago adopted on the Continent, has already justified itself at several important stations in this country, and will no doubt be adopted in many other busy centres.



PLATFORM BARRIERS AT VICTORIA STATION, MANCHESTER, SHEWING COIN-FEED MACHINE FOR ISSUING PLATFORM TICKETS.

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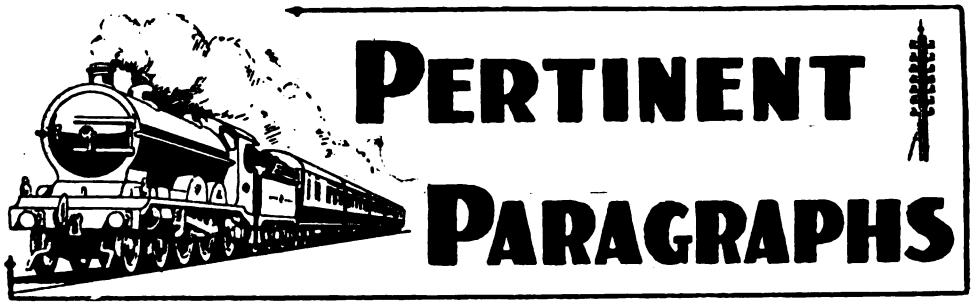

The Railways (No. 2) Bill.

THE thanks of railway companies in the United Kingdom are due to the Prime Minister (Mr. Asquith) for having removed the very painful feeling existing a month ago in relation to the Railways (No. 2) Bill, wherein the Government sought to redeem the pledge given in August, 1911, when the directors of the leading lines promised concessions in order to bring to an immediate end the general railway strike, which, at the moment, appeared to threaten national, if not international, interests. It was frankly acknowledged that the insertion of a time limit to the operation of Bill No. 2 was not contemplated during the negotiations that led to this settlement, but to save themselves from defeat by a combination on both sides in the House of Commons, Ministers agreed to the introduction of Clause 3, which provided that "this Act shall continue in force for five years after the passing thereof and no longer, unless continued by Parliament." This, of course, meant that unless the Act were year after year incorporated in the Expiring Laws Continuance Act, it would forthwith disappear from the Statute book. It is quite true that many important acts are kept alive by this process—involving, of course, annual revision in the House of Commons—but such an arrangement formed no part of the bargain into which the Government had entered with the railway companies. The House of Lords happily came to the assistance of Ministers, and by striking out the clause quoted, enabled the Government to pass the measure in its original shape. Thus disappeared at once all foundation for the charge of bad faith, and Lord Claud Hamilton, the chairman of the Great Eastern Company, acting as the courageous spokesman of the railways, frankly expressed entire satisfaction on their behalf with the course pursued by the Prime Minister in asking the House of Commons to agree to the amendment made by the Lords. It was suggested by more than one speaker who took part in the closing debate that the companies might be disposed to take unfair advantage of the new power with which they have thus been invested; but, with full knowledge of the spirit animating railway directors generally, we unhesitatingly affirm that there is not the smallest foundation for any such fear. In every instance an honest endeavour is being made to carry out loyally, as far as the companies are concerned, the various conciliation arrangements which have been concluded, and there is a growing disposition to show the greatest possible consideration to all classes of railway workers.

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England's "All-Red" Route.

CAPTAIN R. LENDREM-AINSLIE writes as follows:—"A timing of some interest on the North British Railway, and one which appears so far to have escaped general notice, is that of the 1.30 p.m. Scotch express from St. Pancras as between Carlisle and Edinburgh since last October. Originally this train was due to leave Carlisle at 8.2 p.m. and arrive at Edinburgh 10.27 p.m. (advertised 10.25 p.m.), calling at Hawick 9.6 to 9.10, conditionally at Melrose 9.31, and Galashiels 9.38 to 9.40, being equal to a non-stop schedule of 2 hours 11 min. Since October last the timing has been revised, and with a booked stop of one minute at Ridding Junction the train is now accelerated to arrive at Hawick at 9.5, thus giving a 63 min. timing from Carlisle to Hawick with an intermediate stop equal to three minutes' running time. Leaving Hawick one minute earlier than formerly, 9.9, an additional stop at St. Boswells, 9.25 to 9.26, is made, and the conditional stop at Melrose is now absolute, 9.33 to 9.34, the Galashiels times being 9.41 to 9.44, a fast timing of 46 min. for the 33¾ difficult miles from Galashiels making the Edinburgh arrival 10.30. A calculation of the time allowed for station duties, plus the usual allowances for stopping and starting, shows that the timing of this train is equal to a non-stop schedule from Carlisle to Edinburgh of 2 hours 6 min., as against the 2 hours 15 min. usually given to non-stop trains. The engine employed is usually one of the latest 'Scott' class, and while the load is generally very light, ranging from 78 tons to about 100 tons, such a schedule must be considered quite a fast one, taking into account the appalling difficulties of the Waverley route. On various occasions since the beginning of the year I have travelled with this train when, with a punctual departure from Carlisle, we arrived at every station up to Galashiels *before time*. Such a booking even with a light train is very creditable to the North British Railway. Unfortunately, there is another side to the picture. For many years past the 1.30 p.m. has

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been advertised to arrive in Edinburgh at 10.25 p.m. Since the Euston-Derby agreement of 1908 every express from St. Pancras to Edinburgh, with the single exception of the 1.30 p.m., has been decelerated more or less—some very considerably—while through carriage and many other valued facilities have either been abandoned or curtailed. It is therefore all the more regrettable to see this further deceleration of the Midland-Waverley service, notwithstanding the brilliant attempt of the North British Railway to make up by smart intermediate timings for the five minutes later advertised arrival in Edinburgh. I think I am voicing the views of many RAILWAY MAGAZINE enthusiasts of the Midland Railway, than whom there is none keener than the writer, when I express the hope that this summer we may see some material improvement in the Midland-Scotch services, and also in the North of Ireland and Manx services of England's 'All-Red Route.'"

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The Highest Railway Station in the World.

MR. ALEXANDER MOFFATT, Sheriff Substitute and County Court Judge of Stirlingshire, writing to the editor, from Arnotdale, Falkirk, says:—"I find in this month's (February, 1913) issue of your magazine, at page 173, a contributor states that the Jungfraujoch is the highest railway station in the world. I would beg to point out to you that this is not the case. On the Oroya Railway in Peru, there are a number of stations at much higher altitudes. That railway crosses the Andes at an elevation of 4,774 metres above sea level. There is a tunnel at that level going underneath Monte Meiggs. On the West side of the tunnel there is a station called by the same name as the tunnel *Estacion del Tunel del Paso de Galera*. This is 1,994 *feet* higher than the *top* of the Jungfrau. Above the level of the Jungfraujoch are the following stations:

	METRES.
Casapalca	4,147
Paso de Galera	4,774
Yauli	4,090
Oroya	3,712
Cerro de Pasco	4,331

"Cerro de Pasco is the termination of this line—at least it was in 1909 when I was there. It has the unique distinction of being the highest town in the world, being a place of about 12,000 inhabitants with a Mayor and Municipality, and large copper and other mines. It is a thriving, busy town, lighted with electricity and having several marks of civilisation. It is quite close to one of the sources of the Amazon. The Oroya Railway, with its continuation to Cerro de Pasco, has also the distinction of going direct from the sea level to this extreme altitude. Trains start from the quay at Callao and ascend to the altitude already mentioned namely 4,470 metres (15,665 feet) in 171 kilometres. I do not know if any notice of this railway has ever appeared in your magazine, but it is undoubtedly the most wonderful railway in the world. I am not a railway expert, but a mere tourist. I take these figures however, from an official paper published by the railway company."

London and South Western Railway.

IT has been decided to establish on the London and South Western Railway, in connection with the General Manager's Department at Waterloo station, a Publicity Department which shall deal with the whole of the company's business—home and continental. The branch will, therefore, have a much wider scope than the one previously existing under the control of the Superintendent of the Line. Mr. F. V. Milton, of the General Manager's Office, who has been appointed to take charge of the new department, speedily gave proof of his fitness for the office by arranging for the delivery of lectures in French dealing with historical and modern incidents, legends, customs and attractions of Normandy and Brittany. M. Charles Bisson, entrusted with the task, made his first appearance before an audience which filled the large hall at Brunswick House, Wandsworth Road, on Saturday, 1st March. Illustrating his remarks by excellent coloured lantern views, M. Bisson described the chief features of a trip from Waterloo to Havre, Etrétat, Harfleur, Rouen, Honfleur, Trouville, Caen, Falaise, and Vire, returning by way of Cherbourg to Southampton. On Saturday, the 12th instant (April) he will give in the same hall a description of a journey from Southampton to Brittany and back. Mr. Milton, who presided at the inaugural meeting, expressed regret that the majority of Englishmen contented themselves with mastering only their own language. He was, however, gratified to find so much public interest evinced in the subject of the lecture, which could, he announced, be repeated elsewhere either in French or English upon application addressed to the Publicity Department, General Manager's Office, Waterloo station. We understand that requests have already been received from several quarters for the opportunity of hearing M. Bisson.

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"Accidents on Railways."

MR. E. BARRETT, of Beckenham, has written suggesting that in his article "Accidents on Railways," published in the RAILWAY MAGAZINE in January last, Mr. Eric Forrest "treats the South Eastern and Chatham Railway rather shabbily. He wants to find out by statistics 'which railway is the safest to travel on,' and on investigation discovers that the South Eastern and Chatham line is by far the best in this respect; but, instead of giving credit to this company for their careful management (which is undoubtedly the cause of so satisfactory a result), he immediately dismisses the matter in a sentence by saying that the immunity of the South Eastern and Chatham Railway from serious accidents is due to their 'comparatively small number of very fast trains.' I think, if he was to consider for a moment, he would see that it is quite as easy for a train to meet with an accident when going at a speed of 50 miles an hour as it is for one that is travelling, say, at 70. But, as a matter of fact, the South Eastern and Chatham expresses do attain a speed of at least 70 miles per hour on the level or down grade—quite fast enough for derailment, if everything is not in perfect order. And perhaps Mr. Forrest is unaware of the fact, or has forgotten, that there are (or were during the summer months) no fewer than 176 non-

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stop runs daily on the South Eastern and Chatham Railway from 20 miles and upwards. I think the fact that the South Eastern and Chatham Railway has killed only five passengers in a space of 32 years is owing to their very careful management; and it is only fair that a meed of praise should be awarded them for this striking immunity. It is not the practice of South Eastern and Chatham expresses to rush through busy junctions at a speed of sixty miles or so per hour. Mr. Forrest's Table II. on page 55 would have been more interesting if he had stated the *period* covered in the statistics. Without such information, the table is of small value."

We have submitted Mr. Barrett's communication to Mr. Forrest, the author of the article in question, and he in reply writes as follows:—"Mr. Barrett considers that I have treated the South Eastern and Chatham unfairly by attributing the rarity of accidents on that line to their 'comparatively small number of very fast trains'; he thinks the true reason to be 'careful management.' Surely he will admit that *all* the railways do the utmost in their power to prevent accidents? He cannot surely imagine that those railways whose time tables contain 55-miles-an-hour schedules for long distances deliberately *risk* anything. Does he think that a railway company would permit a train to run daily if it were deemed not quite safe? Mr. Barrett next affirms that 'it is quite as easy for a train to meet with an accident when going at a speed of 50 miles per hour as it is for one travelling (say) at 70.' Is this so? Let us bring a little elementary dynamics to bear on the subject. We have a train of mass m, travelling at 50 miles per hour. The driver wishes rapidly to reduce his speed to 20 miles per hour, in order safely to round a sharp bend, which he has approached rather too closely before slackening. To effect this he applies the brakes, and they, in supplying a retarding force, perform a certain amount of work which is equal to the change in the kinetic energy of the train when its speed is reduced. This is easily proved mathematically. The kinetic energy of a body is equal to half its mass multiplied by the square of the speed at which it is moving. Thus the charge in the kinetic energy of the train, and therefore the work to be done by the brakes, is equal to

$$\tfrac{1}{2} \times m \times (50^2 - 20^2), \text{ units,}$$
$$\text{or} \quad m \times 1{,}050 \text{ units.}$$

Now, if we put 70 instead of 50, we have for the work performed

$$\tfrac{1}{2} \times m \times (70^2 - 20^2) \text{ units,}$$
$$\text{or} \quad m \times 2{,}250 \text{ units.}$$

The brakes thus have to do more than twice the amount of work *in less time*. This is one instance. Take one more: Imagine that the train is already on the curve, which is of radius 'r.' Let 'θ' be the angle of elevation of the outer rail above the inner rail. The height of this outer rail has been so adjusted that there is no side-thrust on the wheels of a train moving at a moderate speed, which we will call 25 miles per hour. The horizontal thrust on the flanges of the wheels of our train when it is travelling at 50 miles per hour round the curve is (as is easily proved mathematically) equal to

$$m \times \cos\theta \times \frac{50^2 - 25^2}{r}$$

Putting now 70 instead of 50, we get

$$m \times \cos\theta \times \frac{70^2 - 25^2}{r}$$

Dividing the latter by the former, we have 2·28; showing that the horizontal thrust on the flanges is 2¼ times as great in the '70' train as it is in the '50' train, and the danger of derailment correspondingly greater. Is it worth while pursuing the question further? Mr. Barrett appears to attach some importance to the fact that during last summer 176 non-stop runs were made daily on the South Eastern and Chatham Railway from 20 miles upwards. But does he consider all those 176 runs in connection with '*very fast trains*'? My suggestion was that the South Eastern and Chatham Railway had a '*comparatively* small number of *very fast* trains.' Doubtless this railway is deserving of much praise for its careful management; but I maintain that yet more careful management is of necessity exercised by those companies whose schedules are 'tighter' and whose time tables advertise so many really fast trains. There is only one reason why the South Eastern and Chatham does not run such 'very fast trains,' and that is that it is not necessary. The bigger companies are supplying a great public necessity with their fast schedules. The companies have greater dangers to face and eliminate, and greater care has to be brought into play to preclude all likelihood of mishap. If Birmingham and Margate were to change places, no doubt the South Eastern and Chatham Railway would soon be giving us an 80-minute service between the Metropolis and 'Brum-on-Sea!' While my views on the question at issue do not in their entirety coincide with his, I must thank Mr. Barrett for drawing attention to what many other readers may also have deemed a discrepancy in my contribution."

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Artists and Railway Traffic.

An artist contributor to the popular press having apparently read certain statements concerning the hundreds of signals which have to be passed and duly observed by locomotive drivers during a journey from London to Crewe, has, in the pages of *London Opinion*, endeavoured to depict the impression created in the mind of the driver. The engine can with some difficulty be recognised as a "Precursor," and an array of signals, in endless series, is strikingly suggested; but unfortunately *all the arms are on the wrong sides of the posts!*

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Railway Signalling, in Italy.

We are indebted to Mr. Halvor A. Berggren, of the Gas Accumulator Co., Ltd., Stockholm, for a series of photographs illustrating railway signals as used on the Italian State Railways. Two of these we have pleasure in reproducing. Mr. Berggren writes: "As you are aware, the new signalling system of the Italian State Railways leans much on the English signalling system, but has many interesting characteristics of its own. One of these is the mounting of the distant-arm back of the home signal arm, instead of below, as is customary in England. In Italy they hold that there is no necessity

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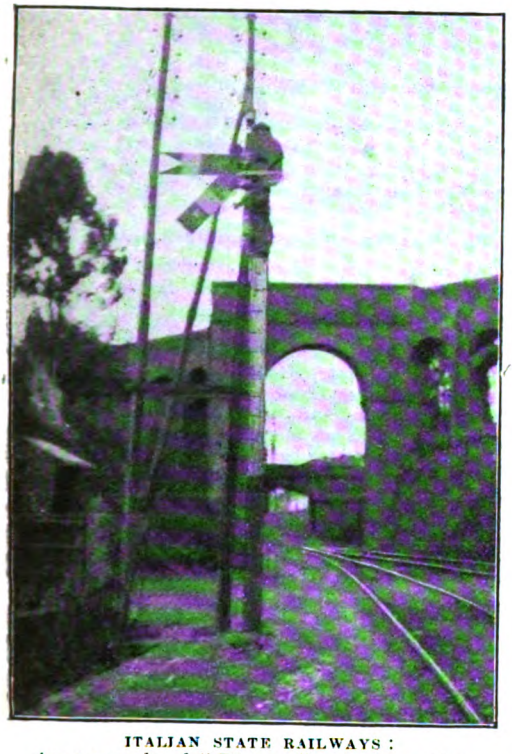

ITALIAN STATE RAILWAYS:
An example of "Distant" signal practice.

of seeing the distant-arm when the signal demands an absolute stop, or a clear road through both blocks ahead is signalled, and I must say that I sympathize to some extent with their views, when I think of the confusion and complexity of signal gantries at large stations."

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The South Manchuria Railway.

In the Railway Magazine (November and December, 1911, January, 1912) an official article was published relating to the great undertaking of the South Manchuria Railway Company. The latest statistics available show that at the end of September, 1911, the rolling stock on the system was made up as follows:—

Broad-gauge—	
Locomotives ..	229
Passenger cars ..	138
Goods cars	2,315
Narrow-gauge—	
Locomotives ..	82
Passenger cars ..	56
Goods cars	647
Total	3,467

At Shakakou the company possess a new and an up-to-date industrial establishment of a remarkable character, together with a colony for the housing of the staff. Four hundred acres have been reserved for these purposes, and the works, covering 11 acres, include a large locomotive and machine shop, boiler shop, smith's shop, foundry, pattern shop, power house, truck, wheel and brake shop, wood mill and freight car shop, cabinet, upholstering and passenger car shop, testing laboratories, locomotive weighing and preparation shed, stores, and other buildings. The whole of the shops are fitted with the most modern machinery and tools, purchased in almost every case from abroad. Repairs can simultaneously be executed to 26 locomotives, 36 passenger cars and 130 freight cars. Cars can also be built at the works, and it has been officially stated the company intend in future to construct a considerable proportion of their rolling stock at these new workshops. The workmen's colony embraces fully one-half of the vast estate, and in addition to a hsopital, elementary school, post office, and other essential agencies, nearly 700 dwellings have been provided for the staff and workmen. More than £580,000 has been expended upon the depot and its surroundings.

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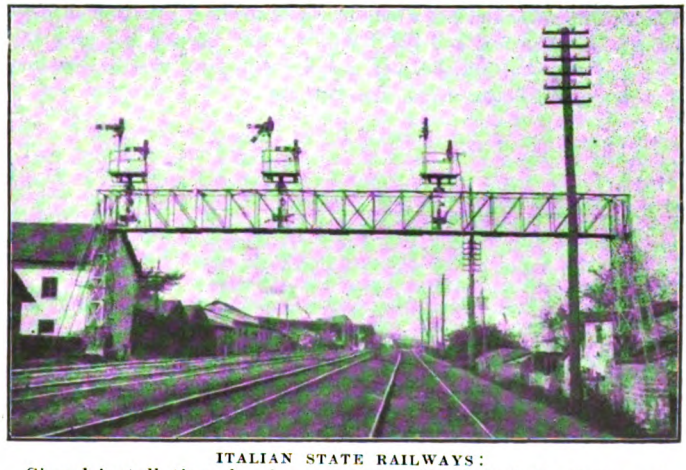
"Railway Magazine" Illustrations.

We have received the following letter from Mr. B. A. Hewitt:—"I was interested in the account of the railway screen given on page 85 of the January issue. It may be of interest to some readers to know that I have a very large collection of photos of trains, locomotives, and railway steamships. Indeed, I am in possession of almost every picture of the kind published in the Railway Magazine since its commencement. My method has been to take two copies for this purpose, thereby enabling me to get every picture, as in many instances there are pictures on both sides of a leaf. These I have pasted into ordinary foolscap books, together with any advertisements which have appeared from time to time, placing them under their various headings, 'Caledonian,' 'Midland,' and so on.



ITALIAN STATE RAILWAYS:
Signal installation showing, on centre bracket, "stop" arm at "clear" and "distant" arm at "Caution."

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I have one special book for foreign lines, and many full of British lines; and these, with the various separate books of coloured plates and RAILWAY MAGAZINE full-page illustrations, form a most interesting collection. With the very best of good wishes for the success of the RAILWAY MAGAZINE, which has been for years a real joy to me, and which certainly becomes more full of interest with each number."

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"Lively Times" in Alaska.

A CORRESPONDENT in Alaska, writing on 8th January last, says:—"We are having lively times up here. Been blocked by snowslides since 21st December. We have got two rotary snow-ploughs and five engines bucking snow, and another plough and two engines dead on the main line, as at present we cannot get fuel to them. To help things out, our engine and trainmen went on strike a few days ago, but we have patched up a truce until we get the line open. I have been working spells of 36 hours straight the last few days, piloting rotaries, shunting and running brakedown gangs. We have got about 3 ft. of snow in the yard here, and shunting is a fine art. We get off the rails on an average about four times a day. The other day a 2–6–0 engine left the rails through running on to some ice, and it took the day yardmaster and I nine hours' hard work to get her back again. After about four hours' work we got all the drivers on, and had just the pony truck left. We got that blocked up and the ramps in position, and took a pull on it with a 2–8–0 'consolidation.' Then a spike broke, the ramp skidded, the engine side-slipped, and next thing we knew all the drivers were down on the sleepers again and left us about where we started!"

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The Preston and Longridge Joint Line.

A reader, who asks whether this line is, as stated in the "Railway Year Book," a joint property, seeing that virtually all its traffic is worked by the London and North Western Company, suggests that it includes the steepest gradient on that system. The line is jointly owned by the London and North Western and Lancashire and Yorkshire Companies, but as regards both passengers and goods is worked entirely by the former. It is not the steepest covered by London and North Western trains as the Chequerbent incline rises at 1 in 30 as against 1 in 75 on the Longridge branch, between Grimsragh and Longridge. The branch is single line, controlled by electric train staff between Deepdale Junction and Longridge stations. Beyond the latter the line is continued for about a mile and a half for goods traffic, and terminate at Lord Derby's quarries.

The Railway Year Book.

THIS volume, universally regarded as the "Whitaker of the Railway World," has just made its sixteenth annual appearance. The contents are more varied and useful than ever, and is invaluable to all who have any interest in transport work at home or abroad. British and foreign railways cheerfully render aid in its accurate compilation, and, therefore, it may almost be classed as an official publication. The maps of the different systems have been either revised or re-drawn, as rendered necessary by developments witnessed during 1912, and the vast amount of statistical information presented has been corrected to date. All the chief railway events of the past twelve months are recorded, and the "Who's Who" section has been supplemented in many particulars. Copies of the book (2s. 6d. net, postage 4d.) may now be obtained at the offices of the RAILWAY MAGAZINE, 30, Fetter Lane, London, E.C.

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A VALUED American correspondent sends us the following items of railway information:—"The U.S. Government has, through the medium of the Interstate Commerce Commission, begun an investigation into the causes of the annual car shortage on American lines, presumably with the view of introducing legislation to regulate the interchange of cars, and particularly the long detention of foreign cars by railways which have not sufficient rolling stock of their own. All the principal railways have been ordered to furnish a fortnightly report to the Commission showing the total number of foreign cars on their line and of their cars on foreign lines, each company's cars and each foreign line being given separately. In addition, there is a summary showing the total number of cars owned and the number of home and foreign cars in repair shops. The report applies only to railway-owned cars and not to private owners' cars.—Among other activities of the American public health authorities, an order was recently issued by the Secretary of the Treasury prohibiting the use of a common drinking cup or glass at stations or on trains. This has been followed up by an order prohibiting a common towel in lavatories. This seems a step in the right direction, and one which might be followed to advantage elsewhere, although I am afraid many companies will construe the order to mean the abolition of drinking cups and towels. Perhaps we shall see a type of penny-in-the-slot machine for vending towels, or the booking clerk may issue one free with each ticket for a distance of, say, over 50 miles.—Railway regulation generally is being reduced to a fine art by the various State Railway Commissions. Following two rather disastrous derailments caused by excessive speed through cross-overs, one eastern railway has been instructed that all trains must be brought to a dead stop before passing through cross-overs which are unsafe for high speed. This regulation seems rather carrying things to an extreme, considering that the *personnel* of the Commissions is not usually composed of railway officials. It is also rather a reflection on the ability of the railway to preserve discipline in enforcing speed restrictions.

In his annual report to Congress, the Secretary of the Interior suggests that on completion of the Panama Canal, all the railway equipment at present in use there should be transferred to Alaska, and used in the construction of a Government railway from the Gulf of Alaska northward to the Yukon River. The country does not present any great engineering difficulties, although there will be considerable snow trouble all winter through the Coast mountains. It would probably be some years before such a railway would earn its working expenses, to say nothing of dividends on the capital invested.—The Northern Central Rail-Road has recently completed construction of a hump marshalling yard at Northumberland, Pa. This yard, approximately 3¼ miles long, is double, having one hump for eastbound traffic and one for westbound. An eastbound train arriving at Northumberland runs into one of the receiving roads. It is then pushed up over the hump, and gravitates down on to the classification tracks. Below these is another smaller gridiron called the "station order sifter," which marshals the contents of each classification track into station order. The cars are finally run on to one of the departure tracks, and made up into trains again There is also a tranship shed and various car repair tracks, as well as a small "ladder" at each end of the yard for storing brake vans. The points of the classification sidings are worked by an electro-pneumatic push-button machine in a signal box located at a summit of the hump, the signalman being furnished with a list for each train pushed over the hump. So that there is no delay in setting the right road for each car. There is standing room in the yard now for about 4,000 cars, and in planning the yard provision was made for future extension to 6,000 cars."

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LORD MONTAGU OF BEAULIEU will preside at a Franco-British Travel Congress—the first of a series—to be held in London in September next. Under the heading of transportation, it is proposed to discuss (1) The Channel Tunnel and Franco-British relations; and (2) possibilities of encouraging popular travel between England and France. The meeting is being organised by the Franco-British Travel Union, which has issued the first number of an official organ "France." This useful handbook contains extracts from a remarkable report by M. Sartiaux, the General Manager of the Northern of France Railway, on "The Channel Tunnel: Yesterday's Dream—To-morrow's Reality." The editors of "France" add: "England has vetoed the construction of the Tunnel, but the Franco-British Travel Union express the hope that the English Government and the English people will soon see their way to grant the necessary concession, and approve of a scheme which will make for better understanding, not only between the 45 million inhabitants of England and the 40 million of France, but also with the whole population of Central and Western Europe—some 150 million people. As the railways have made for peace in the past, the Tunnel would make for peace in the future."

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MISS PRYTHERCH is responsible for another dainty design which appeared on the cover of the Great Eastern programme of Easter

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excursions. As usual, a simple scheme of decoration is adopted—a cluster of narcissi on a light green ground, with the title and monogram in chocolate brown—and the conception is highly artistic. The programme is a very elaborate one, and offers every inducement to travel at Easter on the East Coast. It announces that in addition to tourist, fortnightly, and Thursday, Friday or Saturday to Monday or Tuesday tickets to the East Coast and the Norfolk Broads districts (Aldeburgh, Clacton-on-Sea, Cromer, Dovercourt, Felixstowe, Gorleston-on-Sea, Harwich, Hunstanton, Lowestoft, Mundesley-on-Sea, Sheringham, Southwold, Walton-on-Naze, Yarmouth, issued from Liverpool Street and other London and suburban stations, there will be special excursion bookings on Thursday, March 20, from London (Liverpool Street) and suburban stations to all the principal stations in the Eastern Counties, including Norwich, Cambridge, Wisbech, King's Lynn, Fakenham, also by the Cathedral route to the principal stations in Lincolnshire, Yorkshire, Lancashire, North Eastern district and Scotland. The cheap week-end tickets issued from London on Saturday, March 22, will be available for return on March 23, 24 and 25. On Thursday, March 20, in addition to relieving trains, special trains will be run from Liverpool Street at 11.52 a.m. to Aldeburgh, at 1.33, 4.5 and 7.9 p.m. to Ipswich, Yarmouth and Lowestoft, at 1.30 p.m. to Ipswich, Norwich, Mundesley, Sheringham and Cromer, at 1.33 and 4.5 p.m. to Colchester, Clacton and Walton, at 1.30 and 7.12 p.m. to Felixstowe, at 4.30 p.m. to Hunstanton, and at 4.55 p.m. (special restaurant car express) to Mundesley, Sheringham and Cromer, at 12.3 midnight to Chelmsford, Colchester and Clacton-on-Sea. On Good Friday, with certain modifications and additions, the trains will be run the same as on Sundays. A special train will be run at 5.5 a.m. from Liverpool Street to Ipswich, calling at the principal intermediate stations. Special trains will also be run on several of the branches in connection with trains from and to London. On Saturday, March 22, for the accommodation of persons detained at business until late in the evening, special midnight trains will leave Liverpool Street at 12.20 for Norwich *viâ* Cambridge, and at 12.30 for Clacton, Ipswich, Yarmouth and Lowestoft, *viâ* Colchester, calling at the principal intermediate stations. The 12.3 night (supper train) from London to Clacton will not run. Restaurant cars will be run from London to Colchester and Clacton on the 12.30 night special and will be vestibuled to the Yarmouth and Lowestoft sections as far as Colchester. The midnight supper train from Liverpool Street to Southend will run as usual. The Great Eastern Railway Company also announce that the excursion fare between London (Liverpool Street and Fenchurch Street) and Chingford on Easter Monday will be reduced from 1s. to 9d. Proportionate reductions have also been made from many intermediate Great Eastern suburban stations. By means of its easy accessibility by Tube and Underground railways, Liverpool Street affords a very quick means of reaching the Forest, and the combined fare from the greater part of London will not exceed 1s.

ANXIOUS to make more widely known the attractions of the "Shakespeare route," the Stratford-upon-Avon and Midland Junction Railway Company have issued a little "folder," which shows how this line connects Harvard House, the home of the founder of the famous American University and Shakespeare's birthplace at Stratford-on-Avon, with George Washington's home at Sulgrave. The latter is 2½ miles from Morton-Pinkney station, and on receipt of telegraphic notice the company arrange to convey not fewer than three passengers thence to Sulgrave and back by road conveyance at a fare of one shilling each. The "S.M.J." Railway connects with three great trunk lines—Great Central, Midland and London and North Western—and a frequent service of trains is provided between Stratford-on-Avon and Morton-Pinkney. As the century of peace between Great Britain and the United States of America will be celebrated in England next year, the issue of the folder is particularly appropriate. The "S. M. J." is, of course, closely concerned in the Shakespearean Festivals at Stratford-on-Avon. As indicated in our last issue, the programme announced for the Festival which is to open on the 21st of this month (April) and continues till May 14, is a very attractive one. In addition to Mr. F. R. Benson's Company, the Elizabethan Stage Society, Birmingham Repertory Company, Oxford University Dramatic Society, and the Boys of Shakespeare's School, will appear. Several lectures will be given by Mr. Arthur Bourchier, Mrs. C. C. Stopes, and Mr. F. R. Benson. Other attractions include a concert of old English music, and recitals of old songs and ballads.

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BRITISH enterprise may claim sole credit for the successful Colombian line which extends from the river Fundacion to the port of Santa Marta. The main track is 58 miles long, and branch railways have been laid over 30 miles, with the sole object of providing for the banana trade, which already furnishes fully 80 per cent. of the total freight traffic. Some time ago further extension of the system was projected, but necessary negotiations with the Colombian Government occasioned considerable delay. It is hoped, however, that the new work will be entered upon almost immediately, and pushed forward with all the energy characteristic of the British settlers in this wonderful Pacific region. But the interval that has elapsed was not wasted. It has indeed been well utilised in making many and varied improvements in the existing facilities, chief among the same being the construction in Santa Marta Bay of an extensive wharf whereat vessels of 8,000 tons burden can be accommodated. As another indication of the remarkable progress to be chronicled of Colombia, it may be added that an American fruit company has obtained permission to erect, at Santa Marta, a wireless telegraph station for its own purposes.

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INTERESTED in accounts which have appeared in the RAILWAY MAGAZINE describing events associated with railway operation in Alaska, a reader sends particulars of an encounter with a snowslide on the Great Northern Railway (U. S. A.). He writes: "The scene of the Great Northern blockade is not far from Wellington,

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now known as Tye, where an avalanche struck two passenger trains and killed ninety three persons in February, 1910. Through train No. 43 from Kansas City had just thrust its nose out of a long snowshed at Alvin, on the west peak, when a mass of snow and earth, which seemingly had been lying in wait for the train, leaped down the mountainside, and caught the two engines and the baggage car. The train was stopped, and after the engines and car had been dug out, the train was backed into the snowshed without anyone having been hurt. The passengers endured no hardship, there being plenty of food and fuel. It had been intended to send the train back to Spokane, but there were slides behind also, and passengers clambered down the steep mountain trail from Alvin to Scenic, which is a Winter resort with a hotel. A snowslide three and a half miles east of Leavenworth, on the east slope, struck and instantly killed Joe Teneralli, section foreman of the Great Northern. A rotary snowplow was also struck by this avalanche, and the snow caused an explosion of the boiler, frightfully scalding Engineer Andrews. Seven men were killed on the Great Northern while fighting snow during the storm."

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In their report for the past year the Managing Committee of the London and South Western Railway Employes' Supplementary Pension Society congratulate the members on substantially increased funds. Eleven members joined in the year, two died, eleven left the company's service, and 85 withdrew, leaving a net membership of 421. The total amount standing to the credit of the society in the hands of the London and South Western Railway Company as on 31st December, was £9,647 2s. 11d. National insurances affected the society, some members having to adjust their assurances in view thereof, but the Managing Committee recommend the society more strongly than ever before. The increasingly keen competition for a living emphasises the need of a certain income at 60 or so. The Committee tender thanks to the directors and officers of the company for the collection of contributions through the pay bills, and for the general carrying on of the business of the society through the company's ways and means. The trustees of the society are Mr. H. A. Walker (General Manager), Mr. Henry Holmes (Superintendent of the Line), and Mr. N. Wilson (staff inspector at Waterloo station), the last mentioned being also Chairman of the Managing Committee. Mr. J. Claxton is the secretary.

* * *

We have been favoured with an advance proof of the paper read before the members of the Institution of Civil Engineers by Mr. Eric A. Ogilvie describing the widening and track re-arrangement carried out on the London and South Western and Metropolitan District Railways, between Acton Lane and Galeva Road. The alterations involved were of a difficult and complicated character, but the work was completed without the smallest interruption of either company's traffic. There was a daily service of more than 400 trains, and before the new lay-out could be brought into use 19 temporary diversions were necessary. Since the completion of the work the District Company have been able to increase the number of trains to and from the western suburbs by more than 40 per cent. The general scheme was prepared by Mr. A. R. Cooper, Engineer to the Metropolitan District Railway, and the work carried out departmentally by the London and South Western Railway, under Mr. J. W. Jacomb-Hood, Chief Engineer, and under the immediate supervision of Mr. Harley H. Dalrymple-Hay, Mr. Ogilvie being the Resident Engineer.

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The re-numbering of Great Western locomotives recently carried out has virtually been confined to the later engines of Mr. William Dean's design and the subsequent additions by Mr. Churchward. Public interest in the change will be attached principally to the ingenious yet simple manner in which the pioneer engine of a class has been allotted the first number in a definite series, instead of a miscellaneous number. In every case this has been effected by letting the indicating class number begin with the even hundred, instead of employing a "hundred and one" series, as has been the practice on the Great Western Railway for many years—witness the famous 7 ft. 8 in. singles of Mr. Dean's design, numbered from 3001 onwards to 3080. A few examples may be sited. No. 11, the first of the 2-4-2 side tanks, built in 1901, has become 3600, heading the list of 30 engines Nos. 3601—3630, which were afterwards built. No. 33 the pioneer of the 2-6-0 type of goods tender engine, has become No. 2600. No. 97, the pioneer of the "Consolidation" goods engines, is now No. 2800. Nos. 99 and 115, $\frac{2\text{-}6\text{-}2}{T}$ type with varying wheel diameters, are now Nos. 3100 and 4400, respectively. No. 3473, *County of Middlesex*, and the pioneer of that type, is now No. 3800, heading the series of this class. No. 40, *North Star*, four cylinder simple 4-6-0, has become No. 4000, and No. 100, *William Dean*, the pioneer of the 4-6-0 *express* type on this line, No. 2900. Skill has been shown in allotting the revised numbers to the earlier two-cylinder 4-6-0 engines and converted "Atlantics." These now bear numbers in which the two last digits of the original number are retained. Thus No. 98, *Ernest Cunard*, is No. 2998, and No. 171, *Albion*, No. 2971.

* * *

The official programme of construction on the Grand Trunk Pacific for the current year has been made public in Winnipeg. Whatever policy is adopted with regard to branch lines, it is generally understood that the first consideration of the Company will be to complete the British Columbia section of its main line. The gap between the eastern and western heads of steel in British Columbia is now only 426 miles, and work on this portion of the line is actually under way throughout its entire length. Steel is laid to the Shuswap River, 1,123 miles west of Winnipeg and 154 miles east of Fort George. A steel structure spanning this river will be placed in position as soon as footings (upon which work has commenced) have been completed. East of Prince Rupert, the head of steel is now 195 miles from the Pacific Coast. Between that point and Aldermere several steel bridges have been erected. From Aldermere, the grade continues to the Endaka River, 341 miles from Prince Rupert. Notwithstanding the heavy expenditure involved in the completion of the mountain section, the Grand Trunk

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Pacific will, we are officially informed, enter the towns of Brandon, Moose Jaw, Weyburn, Battleford and Calgary this year, and push forward with all possible speed important extensions already undertaken. This policy will mean the finishing of the Weyburn branch and Regina boundary line, securing of terminals in Moose Jaw for the Regina-Moose Jaw branch (which is complete to a point just north of Moose Jaw), the ballasting of the Battleford branch, and the construction into Calgary of the line from Tofield. On the line from Regina to the international boundary, grading is finished as far as Frobisher, 136 miles from the capital of Saskatchewan, steel is laid for 106 miles to Hill Hall, and 90 per cent. grading is completed on the remaining portion between Frobisher and the American territory. The grade on the Tofield - Calgary branch has virtually reached Calgary, and the line should be in condition forthe operation of passenger trains into that city by August 1 next.

* * *

MR. ALFRED ASLETT, the General Manager of the Furness Railway, when entertaining the members of the Barrow Chamber of Commerce and Exchange at dinner on a recent occasion, gave a graphic account of his experiences in India, Egypt, and the United States. He was present at the great Durbar of 1911, when 70,000 troops and 1,000,000 natives assembled, and enjoyed exceptional opportunities later of making a delightful tour in northern India. The lakes of Udaipur and Ajmere, he acknowledged, were two of the most beautiful in the world, "although they do not," he added, "in all respects excel our picturesque English lakes." He travelled about 20,000 miles in India and Egypt, and in America attended the fifth International Congress of Chambers of Commerce, held at Boston (Mass.).

MR. ALFRED ASLETT,
Secretary and General Manager, Furness Railway.

* * *

As soon as he entered upon his duties as General Manager of the Alexandra (Newport and South Wales) Docks and Railway Company, Mr. J. H. Vickery received an unusually cordial welcome in Newport from the Mayor on behalf of the Corporation, as also from representatives of the local Harbour Board, Chamber of Commerce, and Shipowners' Association. The Mayor said they all recognised how intimately the success of such a great undertaking was bound up with the welfare of the town, and they hoped the cordial relations which had hitherto existed between the Company and the public bodies of the port would continue. Mr. Vickery, in thanking the Mayor and other gentlemen for their kind reception, said he, too, recognised the great importance of the dock company being on good terms with the public bodies of the town, as in a sense it might be said that they would stand or fall together. Therefore, his aim and policy would be to preserve the good feeling which had been referred to, and to encourage the provision of those facilities which would contribute to the success of the port. Prior to this happy gathering the directors at the half yearly meeting of the Company had been warmly congratulated by Mr. T. H. Mordey one of the proprietors, upon having secured the services of such an able successor to Mr. Macaulay. We may add that Mr. Vickery's disappearance from Waterloo has caused sincere regret among the officials of the London and South Western Railway, and the children in the orphanage at Woking were deeply distressed when, at the end of February last, they learned that he appeared among them for the last time.

* * *

"Of all the Southern Isles she holds the highest place,
And evermore hath been the greatest in Britain's race."..

EVER since the poet Michael Drayton, who died in 1631, referred to the Isle of Wight in these terms, the island has been growing in popularity, and no one who has visited its shores can fail to be impressed by its magnificent scenery and luxuriant vegetation. It is indeed a fine spot, and has been truly described as the "Garden of England." There are many charming walks and drives; the bathing cannot be excelled in any part of the world; and excellent golf links are found at Bembridge, St. Helens, Sandown, Ventnor, Newport and Freshwater. The

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island is well served by a good service of express trains from Waterloo, London Bridge and Victoria to Portsmouth, at which point fast and commodious steamers convey the visitor to Ryde, whence there is a frequent service of trains to all parts of the island. The art student, the antiquarian, the geologist, and the historical student each finds much to amuse him in the ancient churches, abbeys, castles, ruins, caves, cliffs and Roman remains. At Easter the island is a glorious holiday ground, and the two railways connecting it with the Metropolis—the London and South Western and the London, Brighton and South Coast Companies—have published very attractive programmes for the holidays beginning on March 20.

* * *

THE Manchester District Ambulance Competition arranged by the London and North Western Railway Ambulance Centre was held on Wednesday, March 5, at Belle Vue Gardens, Manchester. Twelve teams took part in the contest, the judges being Mr. H. G. Cooper, of Altrincham and Mr. J. Knowles Lund, of Stretford. After a thorough examination the London Road Team were declared winners, having obtained 421 marks out of a possible 526. Mr. Carter, District Superintendent, Manchester, attended to distribute the prizes, and was supported by Mr. Booth, of the Goods department, and others. The London Road team will, as winners of the District Competition, receive their prizes at the London and North Western Railway "Final" Ambulance Competition to be held in Belle Vue Gardens, Manchester, on April 9. The second team, Plodder Lane, were each presented with an electro-plate tea-pot; the third team, Ordsal Lane, with cake basket each; and the fourth team, Liverpool Road, each with a set of cutlery. The prize for the best individual competitor was a 30-hour lever alarm clock, which was won by Guard George Rhodes, of the London Road team.

* * *

A COMPANY of nearly 300—the largest on record—assembled at the ninth annual dinner of the Railway Outdoor Passenger Representatives, which was held last month in the Grand Hall of the Criterion Restaurant, Piccadilly Circus. Mr. W. C. Simpson, of the Great Western Railway, presided, and the other companies represented were London and North Western, Great Western, Great Northern, Midland, Great Central, London and South Western, North Eastern, Lancashire and Yorkshire, Caledonian, North British, Glasgow and South Western, Furness, South Eastern and Chatham, London, Brighton and South Coast, and Great Eastern. Among the company were Messrs. James Wright (London and North Western) and E. H. Hill (Great Central) (Past Chairman), Mr. F. Grasemann (London and North Western), Mr. J. M. Eddy (London and North Western), Mr. R. H. Nicholls (Great Western), Mr. S. A. Pope (Great Western), Mr. C. Gibbs (Great Western), Mr. A. A. Haynes (Furness), Mr. H. Hunt (Great Central), and a large number of guests.

* * *

FOUR new pictures are to be seen on the Underground stations. A second one of Tony Sarg's "Humours of London" hits off a bit of the life of a typical London shopping street. "Househunting" is an illustration of a cant phrase pictured to the very word, and shows a pseudo-sportsman stalking a garden suburb across a desert of smoky housetops. "Milestones," reminiscent in words and pictures of our nursery books, exhibits "Progress prancing through the ages" by way of the sedan chair, the Cinderella Coach, and the "Puffing Billy," to find at last its "resting place" in the Underground trains of to-day. The "Thirty-Minute Circle" deals only in hard facts, and at first glance is as uninteresting as usually is that sort of thing. It is a skeleton map on which are indicated the number and variety of residential places which may be reached from the City or Charing Cross within half-an-hour, and to the busy man or woman it is the most attractive of all.

* * *

THE Easter Holiday arrangements of the Lancashire and Yorkshire Company are on the usual generous scale. In conjunction with the London and North Western Railway, period excursions will run to Birmingham, towns in the Black Country, and other centres, *viâ* Manchester (Victoria), Droylesden and Crewe; to Cheltenham, Gloucester, Worcester, *viâ* Droylsden, Crewe and Birmingham, or from Crewe *viâ* Wem and Hereford, or *viâ* Market Drayton; to the Midland and South Western Junction system; to South and Central Wales and to the West of England *viâ* London and North Western Railway and Great Western Railway; to the Eastern Counties *viâ* Wakefield; to London by the London and North Western Railway, with through arrangements to the southern railways; to Scotland *viâ* Preston and Carlisle; in addition to other facilities, and, of course, a wide selection of suitable bookings, day and period, to all parts of the Lancashire and Yorkshire system.

* * *

AT the first general meeting of the reconstituted Institution of Railway Signal Engineers, held at the Grand Hotel, Birmingham, Mr. A. T. Blackall, Signal and Telegraph Engineer of the Great Western Railway, was elected President, and Mr. J. Sayers, Telegraph Superintendent of the Midland Railway, Vice-President, for the ensuing year, the members of the Council being: Mr. W. C. Acfield, Mr. A. F. Bound, Mr. C. Dutton, Mr. C. H. Ellison, Mr. H. W. Firth, Mr. A. Hurst, Mr. R. J. Insell, Mr. C. M. Jacobs, Mr. A. H. Johnson, Mr. P. D. Michod, Mr. G. Neale, and Mr. J. T. Roberts. A paper by Mr. R. J. Insell on "Signalling and its connection with the construction and management of railways" was read and discussed. Information regarding membership may be obtained from the Honorary Secretary, Mr. W. H. Cotterill, Telegraph Department, Midland Railway, Derby.

* * *

THE Great Central Company have been careful in their Easter arrangements to shorten the journey of the long distance traveller by bringing his destination as near to London as possible in point of time. The special holiday programme issued contains an almost unlimited choice of resorts in the Midlands, North of England, and N.E. and W. Coasts, suitable for all tastes and requirements. Express corridor trains equipped in most cases with restaurant cars will leave Marylebone daily during the holidays. Other

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attractive features of the programme are the issue of week-end tickets, with frequent day and half-day facilities to the picturesque villages of the Chiltern Hills and Vale of Aylesbury. Copies of this publication may be obtained free of charge at Marylebone station, Great Central Town Offices and Agencies, or by post from Publicity Office, 216, Marylebone Road, N.W.

* * *

FEW parts of the country are more attractive at Easter than the South Coast, and the London and Brighton Company are certainly doing their best to add to its popularity. The district which stretches from Hastings in the east to the Isle of Wight in the west has a record of sunshine that no English seaside resort can surpass, and although it may not have donned its gayest spring aspect, it is always delightful when the first general holiday of the year comes round. A handy little programme issued from London Bridge gives particulars of the facilities offered for visiting Brighton and all the other favourite centres on the Company's system. There are also the Continental arrangements by the Newhaven-Dieppe route, and for those who cannot go further afield the Surrey Hills and the Crystal Palace, a special service of electric trains being promised to the latter from Victoria and London Bridge.

* * *

MR. JAMES FEIRON will be glad to send post free to any applicant who writes to Edgware Road Station, W., the Easter programme prepared by the Metropolitan Railway Company. Excursion and week-end tickets are being issued from London to many delightful spots in Middlesex, Hertfordshire and Buckinghamshire, the Easter services beginning, as usual, on the day before Good Friday, and continuing till Tuesday, March 25. Additional relief trains will everywhere be run as the traffic may necessitate. On Good Friday and Easter Sunday day and half-day excursions are announced to Chorley Wood, Chesham, Great Missenden, and other country stations; on the same days, as also on Easter Monday, cheap tickets are offered to Eastcote, Ruislip Manor, and many more places; and on Easter Monday there is to be a day excursion to stations as far as Verney Junction and Brill.

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IT is officially acknowledged that during the summer and autumn months of 1912 the passenger traffic on the Government railways in Warsaw was so heavy that on the main lines seats had to be booked weeks in advance, despite the fact that most of the express trains were run in two sections. Even with this duplication, it was difficult to cope with the demands for accommodation. Improved and accelerated services were maintained between Warsaw and St. Petersburg, as also between Warsaw and Moscow. These are greatly appreciated, and the hope is entertained that the State Railway department may be induced to introduce similar improvement in the Alexandrovo service, so that the journey to Berlin may likewise be shortened.

BEFORE many weeks pass, the Kent collieries will be sending forth coal in considerable quantities. At Snowdown, near Dover, a fine 4 ft. 8 in. seam is now being worked, and it is expected that the daily output from this pit alone will reach 400 tons. The total area controlled by the Kent Coal Concessions (Limited) is fully 100 square miles, and some idea of the trade anticipated may be gathered from the fact that the Managing Committee of the South Eastern and Chatham Railway have ordered no fewer than 1,000 twelve-ton coal wagons, all to be delivered during the coming summer. Land in the coal-bearing region is rapidly appreciating in value, and when local properties come into the market for sale they are now advertised as being "within the Kent coal area."

* * *

RAILWAY officers who contemplate introducing the dictaphone into their establishments will be interested to learn that Sir Herbert Marshall recently formally opened in Kingsway extensive premises for the Dictaphone Company. Many well-known business men assembled on the invitation of the Managing Director, Mr. Thomas Dixon, and during the proceedings a "wireless" message of congratulation was received from Commendatore G. Marconi, who, at Marconi House, in the Strand, has one of the largest Dictaphone installations in the country. The company's new offices are a model of modern equipment. Problems of light and air space, to which so much importance is now attached by systems experts, have been carefully and most successfully studied.

* * *

CHEAP excursions are announced on March 20 from London (St. Pancras and Euston) for 5, 6 or 8 days to the pleasure resorts on the Furness Railway. Excursions will also be run, and week-end, 10 days, 11 days, and tourist tickets issued from the principal towns in England to Furness Coast stations, including Furness Abbey. An extended service of steamers will be run on Windermere Lake during the Easter Holidays, and passengers may travel at about single fare and a quarter between all stations on the Furness line. Special mention should be made of the excellent golf courses on the Furness line, those at Ulverston and Seascale being among the finest in the country.

* * *

THE receipts of the Didcot, Newbury and Southampton Railway for the year 1912 have enabled the directors to pay for the first time the full interest on the debentures for the year, after providing for all prior charges. One of the tables in the report shows that the weekly earnings per mile were the highest on record, namely, £20 3s. 11d. When the line was opened in 1882 the earnings for eleven weeks averaged £8 3s. 9d. per mile per week. In 1886 the amount dropped to its lowest point—£6 19s. 3d.—but this fall was consequent upon the 25½ miles of the Newbury and Winchester section being calculated as striking the average.

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In their report, the Directors of the Cardiff Railway that the trade of the port of Cardiff during the half-year ended the 31st December last was the largest on record. The imports and exports at the Bute Docks amounted to 7,089,960 tons, which was equal to an annual trade of 14,180,000 tons. In the half-year capital was expended in the following amounts: Additions to existing works, £1,346; Queen Alexandra Dock, £14,244; new railways, £3,978. A balance of £60,103 was available for dividend. Of this sum £52,500 has been appropriated for that purpose, and £7,603 is carried forward to the current half-year.

* * *

During the present year it is estimated that £135,000 will be spent on rolling stock by the Glasgow and South Western Railway Company. The following renewals of rolling stock have been carried out during the five months ended December 31st last:—Three goods engines and tenders, 2 bogie first-class carriages, 5 bogie third-class carriages, 2 bogie brake third-class carriages, 2 bogie passenger brake vans, 35 goods wagons, 10 covered vans, 5 cattle wagons, 107 ten-ton mineral wagons, and 2 goods brake vans. In addition to the foregoing, 12 engines received boiler renewals and other extensive repairs.

* * *

Mr. Thomas Arnold, who has recently retired as inspector from the service of the South Eastern and Chatham Railway, spent nearly half a century at Holborn Low Level station, and declares that life on an underground line is remarkably healthy. At one time he suffered from a chest trouble, but the sulphurous fumes of the tunnel between Ludgate Hill and Farringdon Street soon cured the malady, and he confessed that he would hardly know what he would do when he had to "live in the open."

* * *

We learn that owing to the rapidly extending lines of the Grand Trunk Railway system, there are a limited number of vacancies for freight audit clerks in the offices of that Company at Montreal, in Canada. Experience in freight audit office or goods station experience is essential, but promotions are very rapid. Applications for positions should be addressed to Mr. Fred C. Salter, European Traffic Manager, Canada's Grand Trunk Railway System, 17-19, Cockspur Street, London, S.W.

* * *

Mr. Cecil J. Allen was the lecturer at the meeting of the Railway Club held at 92, Victoria Street, Westminster, on Tuesday, March 11, his subject being "The work of Great Northern Railway 'Atlantic' Engines: A Critical Survey." His remarks were based on experiences of various engines in the course of over 200 journeys on trains such as the 10.0, 10.10 a.m., 1.30, 2.20 and 5.30 p.m. down expresses and corresponding up services. Some remarkable conclusions followed, and gave rise to a discussion in which Messrs. B. M. Bazley (Chairman), J. F. Gairns, T. F. Covington, H. W. Bardsley, A. W. Bartlett, A. H. Jones, and others took part. The next monthly meeting of the Club will be held on Tuesday, April 8, when Mr. T. W. D. Smith (Chief of the Publicity Department, Great Central Railway) will speak on "The Influence of Railway Publicity." On April 22 the Secretary (Mr. E. J. Miller) will read a paper, illustrated with lantern views, on "The Railways of the Grisons (Switzerland)." A visit has been arranged for Saturday, April 19, to the Neasden Locomotive Sheds of the Great Central Railway. Particulars will be announced in due course in the Railway Magazine of other visits, intermediate meetings and rambles.

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A reader at Brighton sends the following extract from the *Family Herald* dated May 10th, 1845, giving particulars of the speeds and weights of express trains of that day:—"*London and Brighton*, 30 tons average, 50 miles in 1 hour 27 min., or 34 miles per hour (stops included). *Northern and Eastern*, 27 tons, 32½ miles, 45 miles per hour, *South Western*, 33 tons, 78 miles in 1 hour 57 min., or 40 miles per hour. *London and Birmingham*, 27¼ tons, 112½ miles in 2 hours 55 min., or 38 miles per hour. *South Eastern*, 35 tons, 67 miles in 2 hours 28 min., or 28 miles per hour. *Great Western*, 76 tons, 194 miles in 4½ hours, or 42 miles per hour, and one train has kept the same with 94 tons."

* * *

In view of the fact that many railway companies now use road motor vehicles, motor vans and lorries, and own large numbers of ordinary horse-drawn vehicles of various types, the new list of tyres issued by the Avon India Rubber Co., Ltd., of Melksham, Wiltshire, is useful. This firm specialises in solid rubber tyres, and over 1,000 sections are available, either clinched-on or wired-on, according to requirements and construction of wheel. These are available for vehicles of all classes, light and heavy.

* * *

Although the London and South Western Railway Company is in the present Session of Parliament seeking power to run road motors in connection with their train services, we understand that this is intended only as a measure of protection. Nevertheless, the time might come when it would be necessary that, in the public interest, as much as in their own, the company should be at liberty to introduce road motors in districts where they were needed.

* * *

In consequence of the increasing demand for Mr. F. E. Mackay's world-famous photographs of railway trains running at high speed, the publishers of the Railway Magazine have arranged in future to supply unmounted copies 6 in. by 6¼ in. at 6d. each, post free, and enlargements 12 in. by 7 in., unmounted, at 2s., and mounted (to order only) at 3s. each. Readers will thus be given the benefit of the reduction in cost of production by reason of the large quantities now being printed.

* * *

Reduction of fares has led to a still more rapid extension of traffic on the electrified suburban lines of the London, Brighton and South Coast Railway between Victoria, London Bridge, Wandsworth Common, Balham, Streatham Hill, West Norwood, Gipsy Hill, Streatham, East Dulwich, North Dulwich, Tulse Hill, Streatham Common and Norbury.

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We are officially informed that the new high speed steamships which the Belgian Government will run during the summer on the Dover-Ostend route will be named "Stad Antwerpen" and "Ville de Liége." The first of the two has been launched at Hoboken on March 4th. It has already been stated in the RAILWAY MAGAZINE that these new turbine mail steamers will be the first among the vessels plying between Great Britain and the Continent to be provided with the arrangement which almost entirely prevents rolling, and it is scarcely necessary to add that the vessels of the line are the fastest in the Channel. The "Stad Antwerpen" and the "Ville de Liége" will bring to five the number of Dover Ostend mail boats making over 24 knots per hour. In 1903 the Belgian State forestalled all other cross-Channel carriers by equipping all its mail boats with wireless telegraph apparatus. This apparatus is now in course of complete transformation, and, thanks to the introduction of the system of continuous attendance at the receiver, the wireless telegraphic arrangements will ere long meet the most exacting requirements of navigation. From the point of view of safety the new mail boats will be perfectly equipped. There are numerous water-tight bulkheads and automatically acting water-tight doors on Stone's system, and all water-tight doors can be closed simultaneously by an apparatus fitted on the bridge within reach of the commander. The life boats provided on the service have hitherto been calculated to meet the requirements of the Board of Trade regulations; but for the new steamers the carrying capacity of the boats has been voluntarily increased by 30 per cent. Therefore, passengers crossing the Channel in the new Belgian turbine steamers will travel under conditions of safety and comfort hitherto unparalleled.

* * *

"HOLIDAY HAUNTS," the official guide to the numerous popular resorts served by the Great Western Railway in England and Wales and the South of Ireland, has just been issued for the season, which begins at Easter. It is an enormous volume of 620 pages, embracing in detail the whole of the company's extensive system. Arranged in divisions, it contains short descriptive accounts of the chief places mentioned, together with advertisements relating to hotels and houses in which visitors may find accommodation, lists of golf links, maps, coloured and plain, and a large number of excellent illustrations. The book is by far the biggest produced by any railway company in this country, and its annual preparation must involve an enormous amount of labour on the part of Mr. Pope and his assistants at Paddington.

* * *

PUBLIC attention has lately been directed to the control system of railway working by reason of the dismissal from service on the Midland Railway of a goods guard who refused to obey the instructions of a control officer. A strike was threatened, but eventually the guard having made it clear that he had no intention to wilfully disobey the orders of his superior officer, was reinstated. In an official statement the directors recognise that the discussion has shown that it is possible under present regulations and working practice for an employé to fear that he may suffer injustice if an oral instruction which has been given to him, and which is in conflict with the printed instruction, is subsequently denied. The directors are desirous that any such possibility should be removed, and have given instructions that the form of the appendix to the working time-table shall be carefully considered and revised with a view to meeting this point.

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SAUNDERTON (Great Central and Great Western Joint Railway) and Croxley Green (London and North Western) stations were almost entirely destroyed by fire in the early hours of Monday, March 10. In the former case evidences were left that militant suffragettes were responsible, and the second conflagration is also attributed to them. It will be remembered that Croxley Green station was only brought into use in June, 1912. It was a single platform timber structure on an embankment, connected with a brick booking hall on ground level. The latter was illustrated in the October RAILWAY MAGAZINE.

* * *

THE Great Eastern Railway announces the opening of a new Light Railway between Elsenham and Thaxted, on April 1st. It consists of a single line, and is about 5¼ miles long. The line is provided with the following passenger stations and halts: Elsenham station, Henham Halt, Sibleys station for Chickney and Broxted, Cutlers' Green Halt, Thaxted station. The timetable includes passenger and mixed trains to and from the back of the up platform at Elsenham station, and goods trains will be run to and from the goods yard at that station. The Light Railway will be worked by train staff. Where gates are not provided at public road level crossings, cattle guards are provided. Public goods sidings are provided at Sibleys and Thaxted stations. Only one class of accommodation will be provided, and single journey tickets only will be issued. Tickets will be issued on the train. Parcels traffic will be received at and forwarded from Sibleys and Thaxted, but will not be dealt with at Henham Halt or Cutlers' Green Halt. Accommodation is provided at Thaxted station for dealing with horses and private carriages.

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As will be seen from our advertisement pages, a Mechanical Engineer is wanted for the Cochin State, the engagement being for a period of three years at a salary of Rs. 400 per month, rising to Rs. 500 by annual increment of Rs. 50. It is announced that none but those who have professional qualifications and experience need apply.

* * *

WE regret to state that Mr. W. E. E. Jackson, one of the best known Inspectors of the Westinghouse Brake Co., Ltd, died suddenly early in March, in Paris, whither he had gone on business. In Mr. Jackson the Westinghouse Brake Co., Ltd., has lost a competent and zealous employé, who had been in their service for nearly thirty years, and his immediate associates in the company, as well as a large number of personal friends both here and in various European countries, will regret his sudden death.

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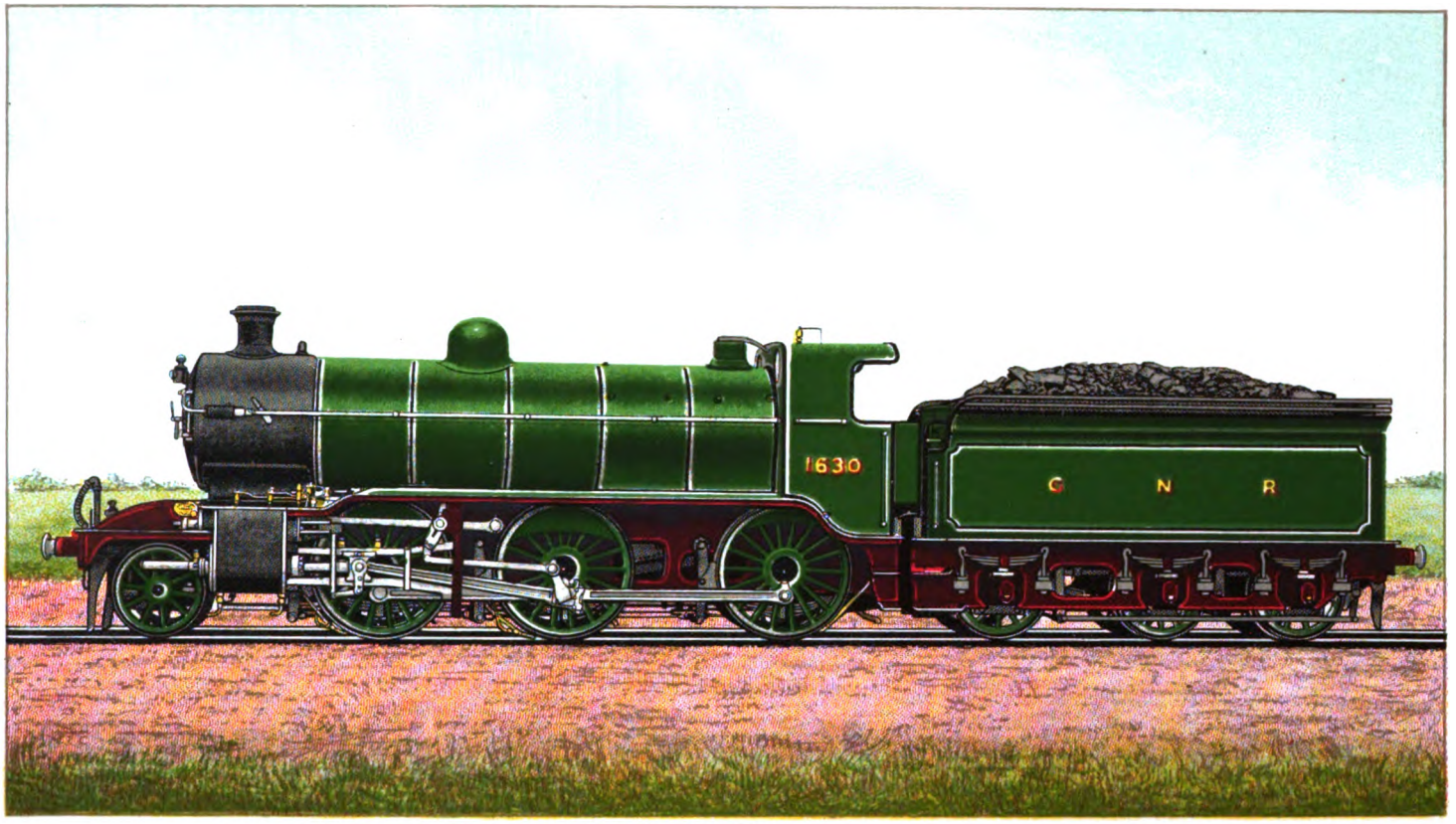

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GREAT NORTHERN RAILWAY SIX-COUPLED MIXED TRAFFIC LOCOMOTIVE, No 1630.

FITTED WITH SCHMIDT SUPERHEATER. DESIGNED BY MR. H N. GRESLEY, LOCOMOTIVE ENGINEER.

CYLINDER, 20 IN. STROKE, 26 IN. COUPLED WHEELS, 5 FT. 8 IN.

TOTAL HEATING SURFACE 1420.8 SQ FT STEAM PRESSURE, 170 LBS. PER SQ IN

GRATE AREA, 24.5 SQ FT

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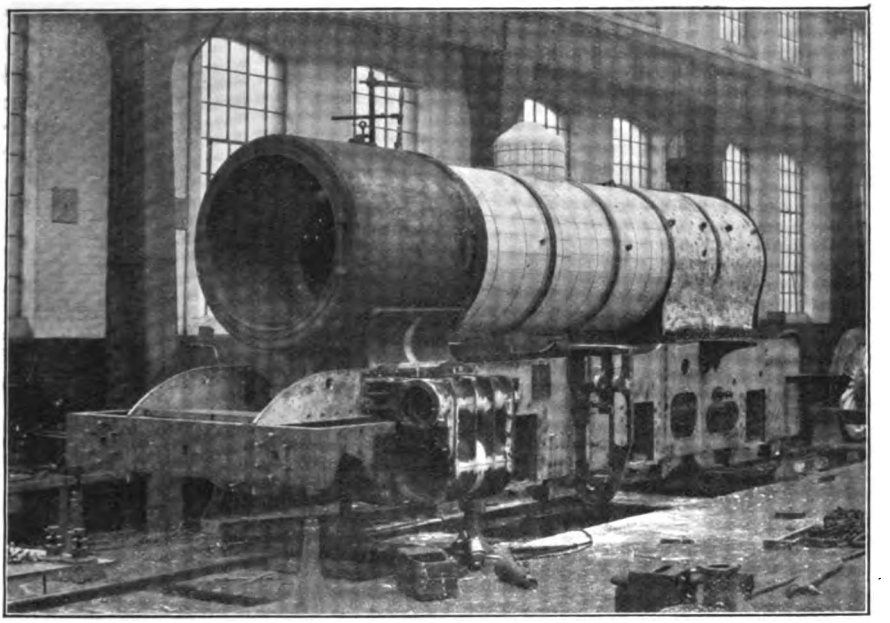

ERECTING ONE OF THE NEW 2–6–0 ENGINES.

The Great Northern Railway Works at Doncaster.

By J. R. BAZIN.

Readers of the RAILWAY MAGAZINE will welcome a detailed description of the Doncaster Works of the Great Northern Railway Company, especially as it comes from the pen of Mr. J. R. Bazin, who is so well fitted to supply full and accurate particulars on the subject.

THE Town of Doncaster, 156 miles from London on the main line of the Great Northern Railway, is perhaps best known to the majority of people as a place in South Yorkshire famous both for its Races and its "Butterscotch"; but to those who take interest in railway matters, it is recognised as the birthplace of the rolling stock of the Great Northern Railway. It was at this country town, now fast becoming the centre of a great coal field, that the directors of the Company decided in 1853 to build shops, and to put down plant for repairing their locomotives, carriages and wagons. Previous to that year, since the opening of the Lincolnshire lines in 1848, all the repair work had been carried out at the small shops at Boston; but that town was considered too far away from the coal fields and manufacturing districts, and Doncaster was selected as a more suitable and convenient place for the headquarters of the Locomotive Department.

When first opened the works covered 11½ acres, and employed about 950 mechanics. To-day they extend over an area of 200 acres, including sidings—33 acres of which are built upon—and find employment for about 4,600 hands. Until the year 1867 all the Company's locomotives were purchased from outside firms. In that year construction was begun at Doncaster, and although at times it has been necessary for some few to be built outside, the number of locomotives constructed in the Doncaster works has now reached a total of 1,380, and for the last 12 years, with the exception of the Vulcan Compound Engine, No. 1,300, all locomotives have been built in those works. At the present time the depot can turn out annually about 50 new engines, 100 carriages, and 2,000 wagons, while 600 engines, 3,000 carriages and 13,200 wagons are repaired.

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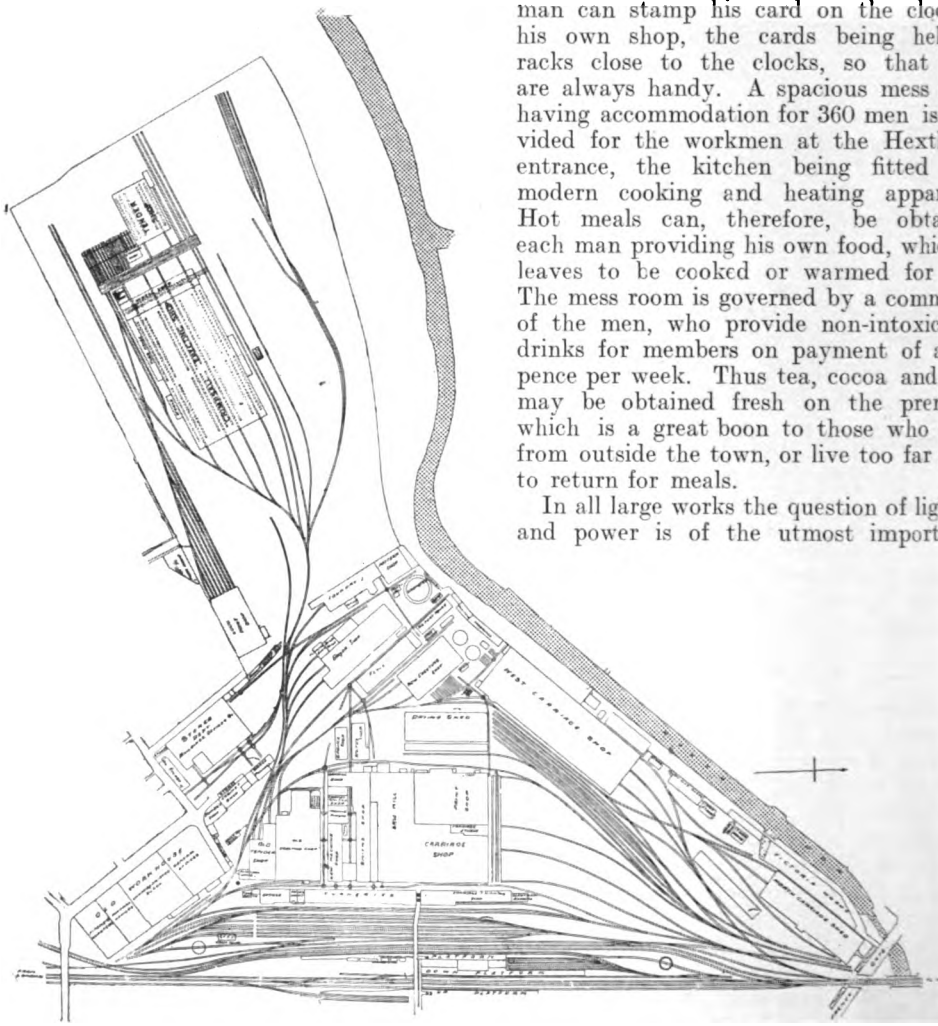
Situate West of the station, the Locomotive and Carriage Works present a frontage to the main line, bounded on the North-West by the River Don. The Wagon Works, are, however, 1¾ miles South of the station in a district known as the Carr, whence they were removed in the year 1890, having previouly occupied part of the present Carriage Works. Occupying the southern end of the buildings facing the main line, the offices are heated by steam, and lighted by both gas and electricity, electric fans being used in several cases for ventilation. On the ground floor are the offices of the Locomotive Superintendent, the Works Manager and his assistants, the Outdoor Running Superintendent, and their respective staffs; while above, the Locomotive Accountant and part of his clerical staff are placed, the other section having a set of offices in a building which until a few years ago was the Doncaster Union, but was purchased by the Company when a more up-to-date workhouse was built outside the town. The old Union adjoins the works, and here also is the Locomotive Drawing Office, equipped with all up-to-date conveniences including a dark room for the photographer, and copying room for printing shop drawings from tracings.

A comfortable reading room and library adjoins the entrance, and is accessible to the workmen at certain hours every evening. The time office is at the South entrance, and here it may be stated that time recorders are used throughout the works. These are fixed in the various shops, and each man can stamp his card on the clock in his own shop, the cards being held in racks close to the clocks, so that they are always handy. A spacious mess room having accommodation for 360 men is provided for the workmen at the Hexthorpe entrance, the kitchen being fitted with modern cooking and heating apparatus. Hot meals can, therefore, be obtained, each man providing his own food, which he leaves to be cooked or warmed for him. The mess room is governed by a committee of the men, who provide non-intoxicating drinks for members on payment of a few pence per week. Thus tea, cocoa and milk may be obtained fresh on the premises, which is a great boon to those who come from outside the town, or live too far away to return for meals.

In all large works the question of lighting and power is of the utmost importance.



DONCASTER PLANT WORKS: GREAT NORTHERN RAILWAY.

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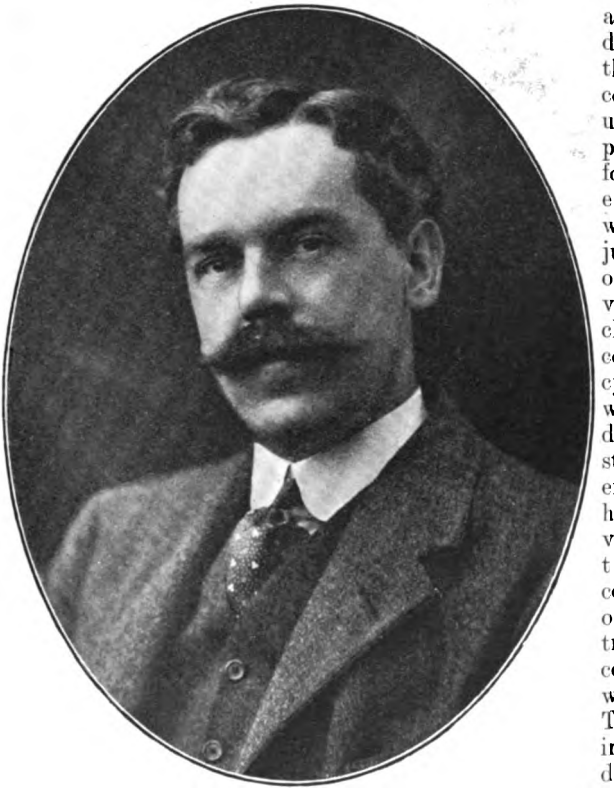
At Doncaster, electricity is chiefly used, and generated on the premises. Until 2½ years ago steam was exclusively employed, but recently two Diesel oil engines have been installed in the Locomotive Works as an auxiliary to the steam plant, and to enable further extensions of electric driving to be carried out; while at the Wagon Shops a large gas producer plant has superseded the steam plant. The steam plant in the Locomotive Works consists of three 350 h.p. Willans & Robinson vertical central valve compound engines and two 150 h.p. engines of the same type, all directly coupled to D.C. dynamos, with a total generating capacity of 836 kilowatts, the voltage being 220. Three Lancashire boilers supply steam for these engines, draught being created in the case of two by motor driven fans, while in the third natural chimney draught is possible.

To minimise losses due to condensation in the main steam pipes, the Holly Gravity Drainage system is installed, whereby the condensed water is returned again to the boilers, while an Allen 3,000 sq. ft. surface condenser capable of dealing with 35,000 lbs. of steam per hour, is used in connection with the exhaust from the engines, both the air and circulating pumps being steam driven for convenience in starting. There is also in the Power House a steam-pressure recording apparatus, which shows any variation of steam pressure that may occur in working. In the Boiler House a CO_2 combustion recorder is connected to the flues, registering the percentage of carbon dioxide in the flue gases. The feed water is supplied to the boilers by a Weir feed pump worked by steam, but injectors, also fitted, can be brought into use in case of emergency.



MR. H. N. GRESLEY.
Locomotive Engineer, Great Northern Railway.

The two Diesel oil engines are placed in separate power houses in other parts of the works. One of 350 h.p. is used for generating power for the large Engine Repair Shops. This is a 3-cylinder, 4-stroke cycle engine running at 190 revolutions per minute, and is directly coupled to a 6-pole shunt wound D.C. dynamo, fitted with interpoles, with a generating capacity of 240 kilowatts. A Reavell 3-stage air compressor, driven direct off the crank shaft, compresses the air up to 800 lbs. per square inch for use in the engine when working, in conjunction with the oil fuel inlet valve, and also charges the two compressed air cylinders, one of which is partly discharged when starting up the engine. An overhead crane is provided for lifting the cylinder covers off, taking out the large trunk pistons and connecting rods when required. The oil fuel stored in a large cylindrical tank outside the Power House, is pumped up daily by a small rotary pump into a tank on a higher level than the engine. Thence it flows through a strainer to the oil pump on the engine which delivers it to the inlet valves on the top of the cylinder covers. The oil fuel is emptied into the storage tank from the travelling tanks by means of vacuum. A pipe is connected from the top of the storage tank to the vacuum pipe on the yard locomotive, while a suction pipe connects the travelling tank with this tank.

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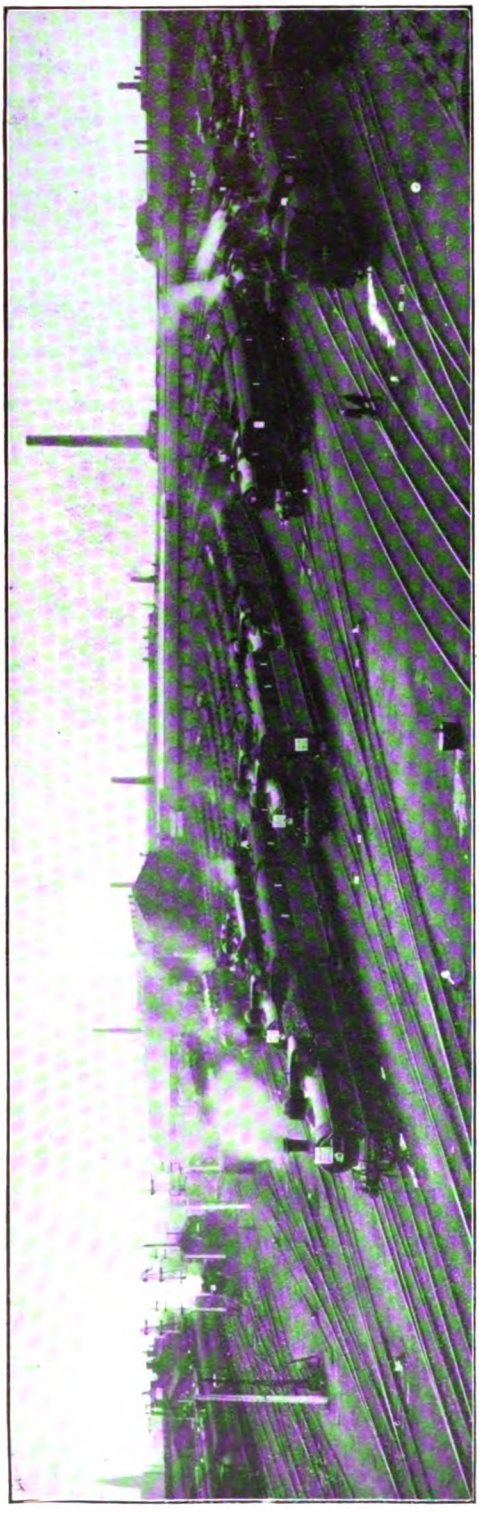

GENERAL VIEW OF DONCASTER WORKS (FROM THE NORTH) DURING SEPTEMBER RACE WEEK.

THE ENGINE REPAIR SHOPS, DONCASTER WORKS.

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Consequently as soon as the large ejector on the engine is worked, a vacuum is created in the storage tank, which must, of course, be made perfectly air tight, and the oil from the travelling tank flows along the pipe and so fills the large tank. The other Diesel engine is similar to the first, but has 4 cylinders and is of 460 h.p. It is placed in a Power House—built in a corner of what was in former times the Engine Repair Shop—and drives an 8-pole shunt wound D.C. dynamo, with a generating capacity of 300 kilowatts. The arrangements for oil storage are similar to the other Diesel engine, but of rather larger dimensions, and the silencers of this engine are placed in a pit below ground, instead of on a staging overhead, as with the 3-cylinder engine. Both these Diesel engines run in parallel with the steam power plant, the engine houses being connected with each other by telephone, so that communication may easily be established between them. Throughout the works a complete system of telephone communication is installed, so that all shops can, through the Exchange in the Works, get into touch with each other.

In modern railway works the Boiler Shop perhaps takes precedence in order of importance. At Doncaster this is 300 ft. long by 100 ft. wide, and is divided into two bays. One bay is served by two overhead travelling cranes of 12 tons lifting capacity, driven by means of square shafting, running in a trough alongside the main girders of the shop. The other bay has one overhead travelling crane of the same capacity, but electrically driven. Power is provided for this shop by means of a 2-cylinder vertical wall engine, driving direct on to the shafting, steam being supplied by two locomotive boilers. The shop is equipped throughout with compressed air piping for working the pneumatic hammers, chisels, and drilling and stay tapping machines at a pressure of 90 lbs. per sq. in. Two vertical air compressors are provided, both being belt-driven from the shop shafting. The larger of these is one of Messrs. Alley & Maclellan's "Sentinel" compound compressors, capable of taking 300 cubic ft. of air per minute, the other being a "Curtis" compound compressor, using 200 cubic ft. of air per minute. At one end of the building is the big Tweddell's system hydraulic rivetter by Messrs. Fielding & Platt.

This machine has a gap of 18 ft., and can exert a pressure on rivets of 25, 50 or 75 tons according to the diameter of the rivet and the thickness of the boiler plate. It is served by an overhead hydraulic crane controlled from the operators' platform capable of lifting 10 tons, so that the largest boiler can be slung and the circumferential seams riveted with the utmost ease. In a small building leading out of this shop is the large hydraulic flanging press, on Tweddell's system, which can exert a pressure of 200 tons. Close at hand is a coal-fired plate furnace, in which the steel plates, such as smokebox tube plates, firebox back and throat plates, are heated before being put under the hydraulic press for flanging. The copper firebox plates are flanged by hand, being hammered on specially shaped blocks after annealing; but the "dishing" for the firehole in the copper back plates is done under the hydraulic press. There is also a smaller hydraulic flanging press, capable of exerting a pressure of 80 tons. This is used for lighter work, such as firebox deflector plates, footplate steps, angle brackets and knees of various kinds. The hydraulic power installation consists of three 3-ram hydraulic pumps and one with 2 rams, all motor-driven.

Two hydraulic accumulators, weighed to 20 tons, each have a stroke of 13 ft. 6 in., and give in the mains a pressure of 1,500 lbs. per sq. in. There is also a portable hydraulic riveter slung from a jib crane, used for fire hole rivets and the rivets of foundation rings. This has a 5 in. gap, and exerts on the rivet a pressure of 30 tons. In the centre of one of the bays are two motor driven shearing and punching machines, used for roughing out plates. These will shear plates $\frac{7}{8}$ in. thick, and punch holes up to 1 in. diameter. A motor-driven plate edge planing machine by Messrs. Craven Brothers will take plates up to 20 ft. by 10 ft. This machine is also fitted with a horizontal revolving table, which will take work up to 5 ft. diameter, such as smokebox fronts and circular tube plates, and machine them on the face or sides. There is a 3-roller horizontal plate bending machine, which will take plates 8 ft. wide by $\frac{5}{8}$ in. thick, and also a 3-roller vertical machine rolling plates 12 ft. wide by $\frac{3}{4}$ in. thick.

Recently a new machine by Messrs. Hugh Smith & Co., of Glasgow, has been installed for straightening engine and tender frame plates. This machine has 6 rollers, is motor-driven, and takes plates up to 5 ft. by 2 in.

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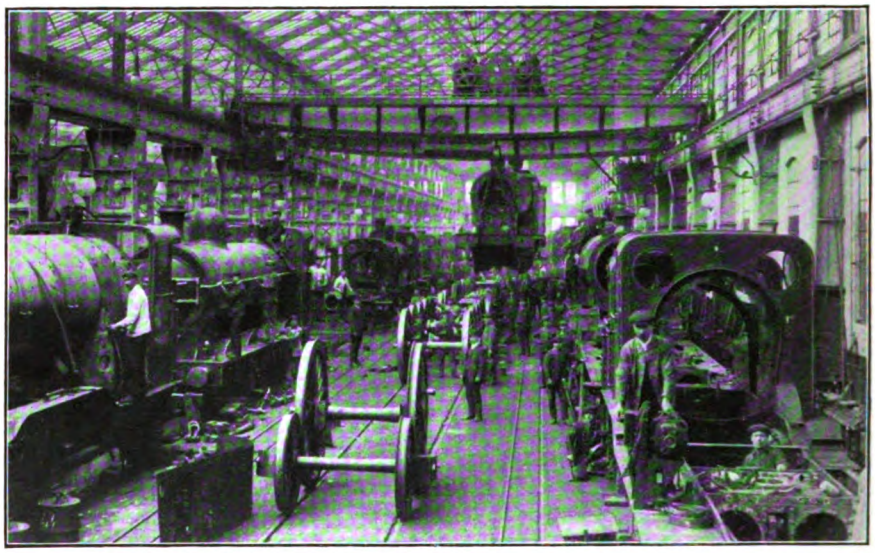
thick. Along one side of the shop are arranged several drilling machines, all driven from the shop shafting. These comprise a set of radial drilling machines for drilling the rivet holes in the boiler barrel plates and the stay and rivet holes in the firebox casing plates; also two twin spindle machines for drilling tube plates, a horizontal drilling machine with 8 ft. bed for drilling rivet holes round flanges of tube plates and smokebox angle rings; and a vertical 6-spindle drilling machine for drilling the rivet holes in foundation rings. On the opposite side of the bay are two radial drilling machines for drilling roof stay holes in firebox casings after bending, stepped jackets being used so that the drill will enter the round surface of the plate at the proper angle. The stay holes in the copper fireboxes are also drilled here after being marked off for the purpose from their actual position inside the casing. These machines, together with a fine high speed radial drilling machine by Messrs. Asquith, are motor driven, this latter having a radius of 8 ft. and a clearance under the spindle of 8 ft. 3 in. It will drill a 2 in. hole through mild steel at the rate of $2\frac{1}{4}$ in. per minute.

The Stay Shop leads out of the Boiler Shop, and here is a small plant laid down solely for the manufacture of copper firebox stays. These machines are operated by boys, under a chargeman. A circular saw cuts up the copper bar, out of which the stays are made to the proper length. The short lengths are then passed through some small rollers, which straighten them. They are next centred by a pneumatic tool in a centring machine, and passed to a special lathe, which turns them at the ends and in the middle, the tool rest being guided by a "former." Afterwards the threads are struck and chased, and the stay is then ready for use. Another set of lathes is occupied in turning and screwing the iron roof stays, which have been manufactured in the Smithy on swaging machines, being drawn down in the centre from iron bar. In this same shop is a "Vincent" patent friction geared rivet-making machine. The rivets are first cut to the right length in a special shearing machine, and then heated in a revolving rivet furnace, after which they are passed on to the Vincent machine, which forms the head.



IN THE ENGINE REPAIR SHOPS, DONCASTER WORKS.

On the South West side of the Boiler Shop is the Iron Foundry, which is 182 ft. in length and 60 ft. wide, the weekly output being about 100 tons of castings. Two cupolas of 6 tons per hour capacity are placed half way down, just outside the building. The charging stage overhead is served by a hydraulic lift, which raises the coke, pig iron or scrap to the level of the charging mouths of the cupolas. A rotary blower, belt-driven from shafting, supplies the blast to the cupolas, the power being derived from a single cylinder wall engine,

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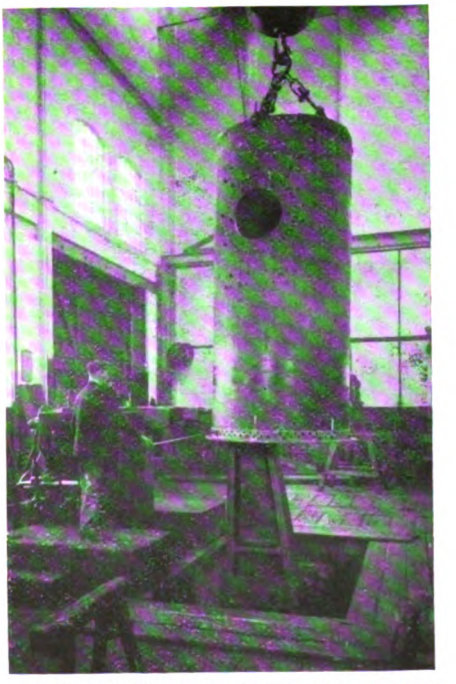
which also drives the Pattern Shop shafting. Used at a pressure of about 24 inches of water, the blast is conveyed through iron trunking from the blower to the air belts of the cupolas. Inside the Foundry is an overhead travelling crane of 15 tons lifting capacity. This is at present steam-driven, but is shortly to be replaced by a new crane electrically driven. All round the Foundry is an overhead "Runway," capable of taking loads up to one ton capacity. This is very useful for dealing with the smaller ladles when carrying the molten metal to parts of the shop which cannot be reached by the big crane. At the top end is a small shop in which are the sand grinding, sifting and mixing machines. Next come the core-makers benches, a small gas-fired core oven being placed here.

At this end of the Foundry all the cylinder moulding is done, two large core ovens gas or coke-fired being close at hand. All the heavy work is carried out in the centre of the shop, while the lighter jobs occupy the sides. Here are three pneumatic power moulding jarring machines, engaged chiefly in turning out wagon and carriage axle-boxes at the rate of 16 per day from each machine. There is another pneumatic power moulding machine, and a hydraulic moulding machine used for small repetition work, as well as a hand-worked firebar moulding machine. The Fettling Shop is a small building outside the main Foundry entrance. There all castings (except the largest, which are fettled in the shop) are taken to have their rough surfaces and runner marks chipped off. The fettling is mostly done by hand, except in the case of small castings, which are cleaned up on emery wheels, specially arranged so that all the fine iron grindings and dust are carried away through trunking by draught created by a motor-driven fan.

The Brass Foundry, some little distance across the yard from the Iron Foundry, contains 20 crucible fires, arranged down one side of the shop. Plumbago crucibles are used for melting the metal of about 112 lbs. capacity, the various metals being weighed in order to get the proper proportion for each alloy. For larger castings a coal-fired furnace is used, having a capacity of about 10 cwts. of metal. An overhead runway is carried from this furnace the whole length of the shop. A "Tabor" pneumatic power moulding machine is used for making small brass castings which are required in quantities from metal patterns on plates 14 in. by 16 in. In the Brass Fettling Shop is placed a fettling drum, driven from shafting by motor, and there are also some emery wheels for grinding castings. The Pattern Shop is conveniently placed next to the Iron Foundry, with the Pattern Stores leading therefrom. Along one side are some wood turning lathes, driven from overhead shafting by the wall engine before mentioned. There is also a 3 ft. circular saw, a universal dimension saw, a planing machine and a band saw, all driven by the same engine from underground shafting. On the opposite side of the Boiler Shop to the Iron Foundry is the Forge, 265 ft. long by 60 ft. wide, and open on both sides for about half its length. It contains three 40 cwt. steam hammers, each having a coal-fired furnace with natural chimney draught. The output is about 550 tons per annum.

Beyond the steam hammers is the Stamping Shop. Here is a battery of 4 Brett steam-driven drop hammers, the sizes of the hammers being 10 cwts., 16 cwts., 25 cwts., and 30 cwts. At the present day drop stampings play an important part in the production of the numerous standard repetition items in the construction of railway rolling stock. By means of these hammers considerable economy has been



LARGE HYDRAULIC RIVETER, BOILER SHOP.

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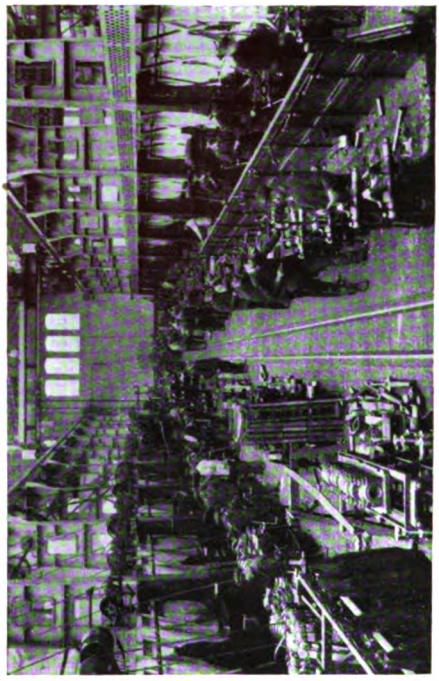
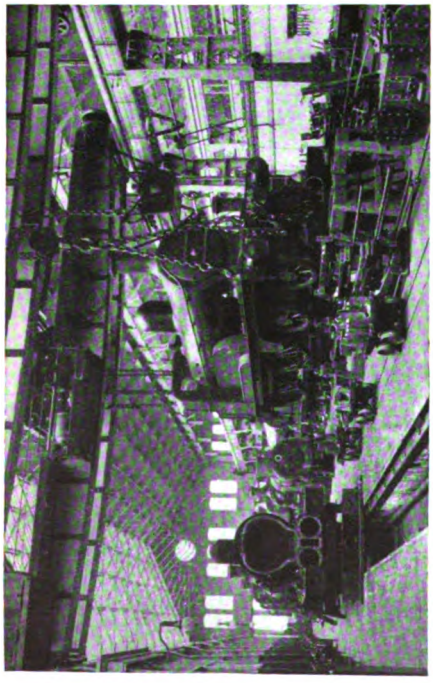


ENGINE REPAIR SHOPS: MOTION REPAIRING BAY.

ONE OF THE MACHINE SHOPS.



ENGINE REPAIR SHOP.

ENGINE REPAIR SHOP: MACHINE BAY.

DONCASTER WORKS.

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effected, and the rate of production increased to an almost incredible extent when compared with the old method of smithing by hand and under small steam hammers. From these 4 drop stamps the average annual output is 630 tons. The dies are cut in mild steel blocks on a special milling machine, and afterwards case-hardened on the face. These generally remain good for fully 2,000 impressions, and when worn can often be re-cut. The "beard" or "fin" is removed by a special cutter under the same hammer.

Ordinary smiths' hearths are employed for heating, but there are also 2 oil-fired furnaces for use when required. The draught for the fires and furnaces is provided by a rotary fan, driven by a small horizontal engine, the pressure being about 10 inches of water. This engine also drives an "Ajax" forging machine, capable of taking bars up to 3½ in. diameter. The "heading" tool is worked direct off a crank on the main shaft, and the side tools on one side only by means of toggle joints. Great power is thus obtained. The annual output of the machine is about 300 tons. There is virtually no wastage of material, as the action of upsetting forces the surplus stuff on to the end of the bar which is being forged ready for use the next time. With this machine two "Ferguson" oil furnaces are used for heating the bars. At the same end of the Forge there is an 80 tons horizontal hydraulic press, by Sir William Arrol & Co., used for making knees for wagon frames, etc. There is also a 10-ton horizontal hydraulic press engaged in smaller work. Coupling links can be bent on a special machine attached to the ram.

The Smiths' Shop, 385 ft. long and 75 ft. wide, contains 83 smiths' hearths. Blast is provided by a 50 in. fan motor-driven from one end of the shop, and by two 48 in. fans driven from shafting at the opposite end. Twenty-two of the fires are placed in a bay alongside part of the large shop. Draught for these is supplied by a motor driven 35 in. fan, down draught created by another motor driven fan being used to carry away the fumes. Down the centre of the shop are two 15 cwt. and nine 7 cwt. steam hammers, also a pneumatic power hammer belt driven from shafting, a Bradley cushion hammer for small work, and three small steam hammers placed in the bay. In the centre of the shop is a steam shearing machine capable of shearing iron bar 3 in. by 1 in. or 1¾ in. diameter. Steam is supplied to this shop by a Lancashire boiler, fitted with a "Sugden" superheater. There is also a reeling machine by Crow, Harvey & Co., straightening iron or steel bars from ¾ in. diameter to 2 in. diameter. At one end of the shop is a small gas furnace for heating high speed steel machine tools, which are afterwards hardened in a cold air blast close at hand. In the Bolt Shop, which adjoins the Smithy, are four Horsfall bolt and nut-forcing machines, together with three Ryder swaging machines, generally employed in making roof stay bolts. Circular saws are attached to the machine for cutting off the iron bar to the required lengths. All these machines are motor driven.

On the further side of the Forge away from the Boiler Shop, is the new Engine Erecting Shop, 230 ft. long by 113 ft. wide. It is divided into two large bays 48 ft. wide, with a smaller machine bay in the centre. One of these bays is devoted entirely to the erection of new locomotives, while the other bay is used for plate work, such as the construction of cabs, splashers, smokeboxes and tender tanks. Each large bay is served by two rope-driven overhead travelling cranes by Messrs. Craven Brothers, capable of lifting 30 tons apiece. Power for the shop machinery is derived from a 2-cylinder vertical wall steam engine, and two 46 cubic ft. compound air compressors supply the shop with compressed air for the pneumatic drills. In each of the large bays three roads run the full length, the two outer roads in the engine erecting bay being constructed with pits, over which the engines are built. In the Machine bay are two vertical boring and turning mills. One, a "Bullard," has a table 42 in. diameter and two heads. There are also three radial drilling machines, a screw cutting lathe and a slotting machine, a pipe screwing machine (which screws pipes from 1 in. to 4 in. diameter) and a machine for facing up pipe flanges. At the top end of the shop is a vertical band saw by Noble & Lund, together with a patent filing machine by the same firm for sharpening the teeth of the band saws. In the Plating bay is a vertical heavy punching shearing and angle iron cutting machine by Fairbairn, Naylor & Macpherson, which shears steel plate up to 1½ in. thick; also a plate rolling machine by Rushworth & Co., with a set of 7 rolls, taking plates up to 6 ft. wide by ½ in. thick. There is further a 15 ft. horizontal plate edge planer by Fairburn, Kennedy & Naylor. The number of new locomotives under

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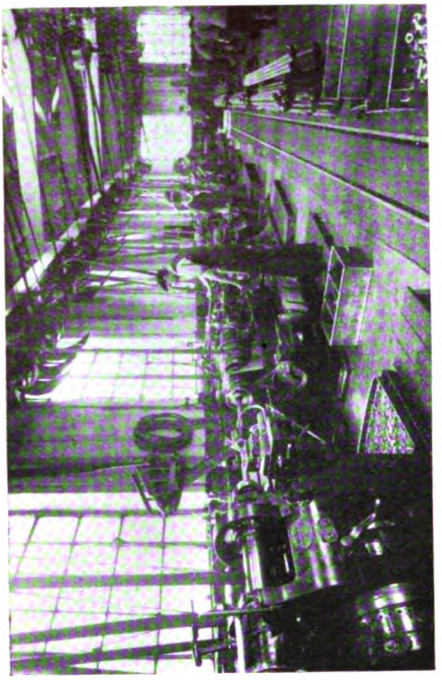
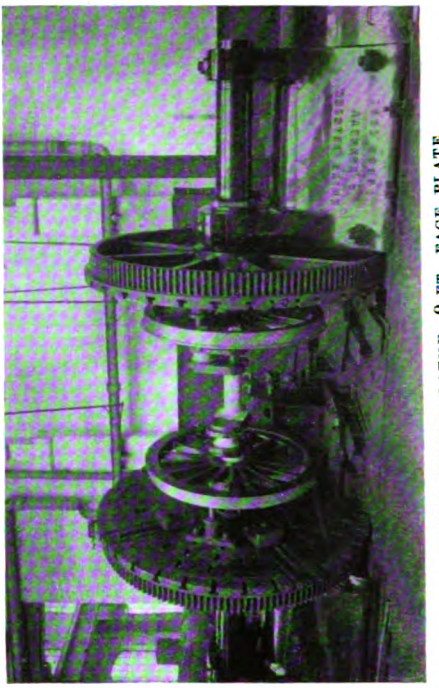
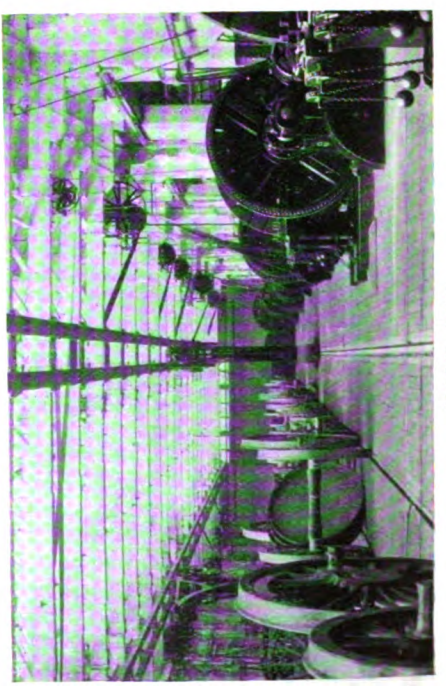


GROUP OF AUTOMATIC LATHES.



LARGE WHEEL LATHE, 9 FT. FACE PLATE.

UPPER TURNERY.



WHEEL SHOP.

DONCASTER WORKS.

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construction in this shop at one time is generally about 10, the annual output being 50.

The Engine Repair Shops are situate at the South West extremity of the works, and as far as repair work is concerned may be said to be self-contained. Electricity is used throughout, power being derived from the 350 h.p. Diesel engine previously mentioned. The Repair Shop itself, 520 ft. in length, is divided into four bays, each 52 ft. wide. Each of these bays has three roads, the two outer ones having pits and the centre road for half the length of the shop. On these outer pits there is accommodation for 100 engines, the pits on the centre roads only being used for stripping the engines when they first come in. There is also a complete system of 18 in. gauge tramroads running through the shops everywhere both inside and out, for conveying the engine parts where required. Two smaller bays, 30 ft. span, run the whole length of the shop on either side between two of the larger bays, and are occupied by boilersmiths, coppersmiths, motion gangs and machinists. Each of the four large bays is equipped with two overhead 4-motor travelling cranes, capable of lifting 35 tons each at a rate of 3½ ft. per minute. They are likewise provided with a 7-ton auxiliary hoist, which lifts at 12 ft. per minute. The cross traverse is 70 ft. per minute, while the longitudinal traverse is 120 ft. per minute. Each of the small bays has an 8 ton 3-motor crane. There are four motor-driven air compressors in the shop, the largest being a 300 cubic ft. vertical compound "Sentinel" compressor by Messrs Alley & Maclellan; next a 200 cubic ft. vertical compound "Boreas" compressor by Lacy Hulbert & Co., and two 100 cubic ft. vertical compound "Curtis" compressors. All discharge into common air pipes, which are conveyed round the shops, together with the electric current for use where necessary.

Hot water pipes are utilised for heating the shops, the lighting being done by electric arc lamps overhead and gas burners along the benches. The shops are spacious, very lofty and well lighted, the half of each roof facing the North being glazed. Half way down in each bay is placed an office for the foreman, while a large overhead office, with two small offices, stands in the centre of the shop for the head foreman erector, boilersmiths' foreman, and their clerks. The Shops Stores, in an annexe on the East side of the Shop, are well equipped with suitable racks and shelves for the storage of material, each group of articles having a receptacle to itself. On the opposite side of the shop is the boiling bosh, the three tanks of which are heated by steam from a small boiler. Here all the parts of the engines which come in for repairs are brought after stripping and boiled in the tanks in a solution of caustic soda, which scours off the grease. They are then sent to the various shops to be repaired, and when ready are returned to their respective engines. At the far end of the Bosh House is a small Metalling Shop, where axleboxes, big end brasses, etc., are metalled up with anti-friction metal.

One half of the Machine Bay is fitted with benches for the motion repair gangs, the other half being devoted to machine tools. Among the machines in this bay may be mentioned a vertical "Bullard" boring mill, with table 37 in. diameter; a double vertical head lapping out machine by Messrs. Beyer, Peacock & Co., also a horizontal lapping out machine, both of which are used for lapping out holes in the various parts of the motion, to ensure them being round, so that the pins which go in make a good and proper fit. There are also two self-acting emery stone grinding machines for slide bars. One of them, by Messrs. Samson Fox Brothers, uses a dry stone, and the other, by Messrs. Craven Brothers, a wet stone. In both these machines the work is fixed on a bed which has a horizontal traverse, the revolving emery wheel having a cross traverse. By these motions every part of the bar is ground, the result being a true and finished surface. Two self-acting emery stone grinding machines for piston rods—one by James Archdale & Co., and the other by Messrs. Craven Brothers—are in use. One of these has recently been adapted to take the long tail piston rods of the superheater engines. At the top end of the bay are four double axle roughing and finishing lathes, together with a 16 in. centre axle ending and centreing lathe by Messrs. Craven Brothers.

The Wheel Shop is at the West end of the engine repair shop, and is 60 ft. wide by 292 ft. long. Lathes fixed along the sides of the Shop are driven in groups by motors, except two big wheel lathes with 7 ft. face plates by Messrs. Craven Brothers. Possessing their own motors, these have in each case four tool rests holding six tools, so that in turning out new tyres on a pair of wheels the tread and both sides may be

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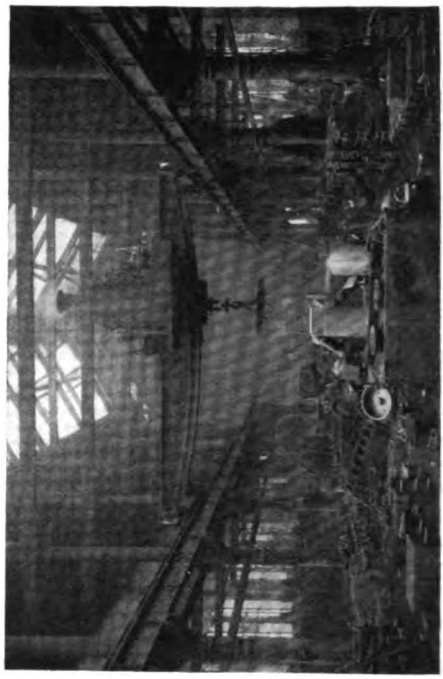
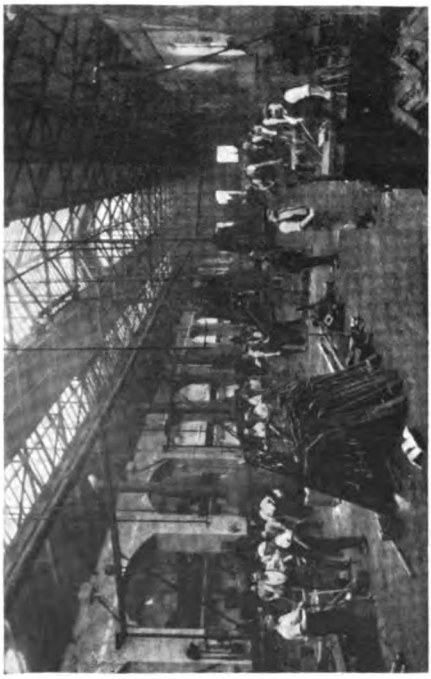
DROP HAMMERS.



IRON FOUNDRY.

DONCASTER WORKS.



SMITHS' SHOP.

THE FORGE.

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machined at the same time. A large wheel lathe by Messrs. Smith, Beacock & Tannett, with face plates no less than 9 ft. in diameter, is of interest, having been specially obtained to take the 8 ft. wheels of the famous "Stirling" single-wheelers. Quite recently a fine wheel turning and tyre boring lathe by Messrs. Craven Brothers has been put down. This has face plates 8 ft. 6 in. diameter, with four tool rests, and is usually employed in boring wheel centres and tyres.

A 2 ft. 6 in. centre crank axle web cutting lathe by Messrs. Fairbairn, Naylor & Macpherson is also worthy of attention. It can be so set, by means of cams operating the belts of two different speed counter-shafts, that for three quarters of each revolution, when both the crank webs are not in contact with the tool, the speed is increased, and reduced again when the webs approach the tool. There are also tyre screw drilling machines, and a wheel quartering machine which trues up the outside crank pins of coupled wheels to ensure that those on each pair shall be exactly at right angles to each other; a key seating machine, which cuts the keyways in coupled wheel centres; also a keyway cutting machine for axles with two heads, arranged so that the keyways are in each axle cut at right angles to each other. To feed the lathes, down each side of the shop are two electrically driven walking cranes, each capable of lifting six tons. There are two hydraulic wheel presses. One capable of exerting a pressure of 254 tons on the ram, has an automatic pressure recorder attached, and the other a small one gives a maximum pressure of 165 tons. Just outside the shop in the Tyre Shed is a ground tyre heating furnace arranged to take all sizes of tyres up to 8 ft. in diameter. This is gas fired through rings of ordinary Bunsen burners, and is served by an electric jib crane. When the wheels have been completed in the shop, they are either returned immediately to the engines or placed in a wheel park outside the shop, where they remain until required.

Across the Wheel Shop, the centre road from each of the four bays in the Engine Repair Shop leads to an electric traverser, 40 ft. long. This is fitted with winding gear, and the repaired engines are hauled out by ropes at this end of the shop on to the traverser, from which they are hauled by means of snatch-heads on to a road at the side of the shop, thence to be taken by the yard engine to the paint shop. On the opposite side of the traverser to the Wheel Shop is the Steaming Shed, containing four roads with pits. Here all engine boilers from the Repair Shop are steamed and tested. The coppersmiths occupy half of one of the smaller bays in the Engine Repair Shop. Arranged down the centre of this bay are six open fires. Draught is provided by a motor driven fan, and over each fire is a bonnet, hung round with asbestos curtains, and connected to trunking, through which the fumes are drawn into the atmosphere by another motor driven fan. On the East side of the main building is the Tube House, 200 ft. long and 24 ft. wide. At one end are three cylindrical "Rattling" machines for cleaning boiler tubes. While they are revolving, water is passed through to wash away the powdered scale that comes off the tubes.

The next division is fitted up with circular saws, boring machines and emery wheels for cutting the tubes, boring the short copper ends that are to be brazed on, and grinding the ends of the main tube intended to receive the short ends. Four vertical gas fires are used for brazing on the short ends, the jets of air and gas heating the tube just where the join comes, a strip of sheet spelter having previously been inserted between the tube and the short end. A hydraulic tube stretching machine, placed at the further end of this shop, is used for stretching steel tubes to their original length, after they have been in use and been shortened by having their damaged ends cut off. The extent a tube is stretched is usually about 4 in. To accomplish this, the tube is held at either end by two grips, one attached to the bed of the machine, and the other to the ram of the hydraulic cylinder. These grips tighten on to the tube as movement takes place, and so hold it fast while stretched to the required length. With a tube 2 in. diameter a pressure of 13 tons is required for this purpose, the result being that the elongation is effected without any apparent alteration in the size of the tube. The hydraulic power is derived from a motor driven 3-ram horizontal pump attached to the machine.

On the same side of the traverser as the Steaming Shed, but to the North West, is the Tender Shop. This is 200 ft. long, and is divided into two large bays, with a smaller bay between. The two large bays, 52 ft. wide, contain three roads, each with pits running the whole length of the

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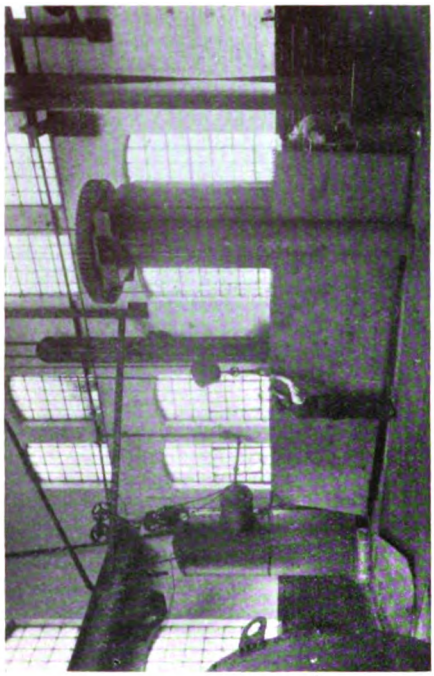
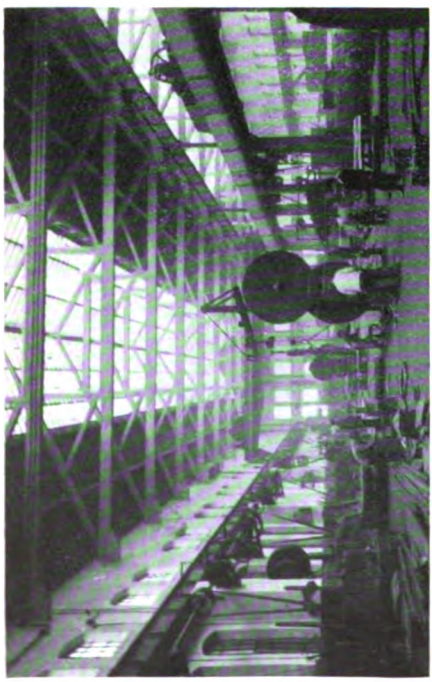
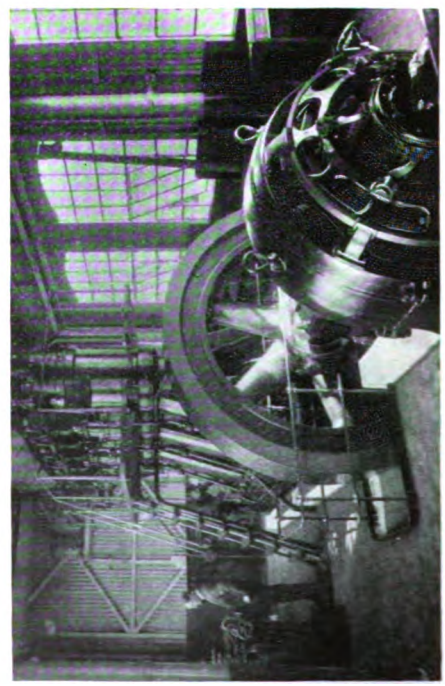


12 FT. VERTICAL ROLLS, BOILER SHOP.

SAW MILL.



BOILER SHOP.



3-CYLINDER DIESEL ENGINE AND ELECTRIC GENERATOR.

DONCASTER WORKS.

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shop, giving accommodation for about 32 tenders. Each bay is equipped with two overhead 3-motor travelling cranes, each with a maximum lifting capacity of 20 tons, the lifting rate being 4½ ft. per minute, the cross traverse 70 ft. per minute, and the longitudinal traverse 130 ft. per minute. Like the Engine Repair Shop, this Shop is heated by hot water pipes, and lighted by both gas and electric arc lamps. Compressed air is also carried round the shop, and a boiling bosh is placed just outside the west end. At one end of the small centre bay is the foreman's office, with the Shop Stores leading therefrom; and just beyond is the vacuum brake-testing apparatus, on which all brake cylinders and ball valves are tried before being put up in position on the engines and tenders. The vacuum is created by a vacuum pump, driven off the shop shafting running down one side of the bay, and from the same shafting are also driven a pipe screwing machine, a radial drilling machine, and a small air compressor. An acetylene gas generating plant is found in the yard on the East side of the Engine Repair Shop, the gas holder having a capacity of 100 cubic ft. This is used in conjunction with compressed oxygen cylinders for cutting up old boilers and tanks with the oxy-acetylene blow pipe.

The Paint Shop is situate a little distance away from the big Repairing Shops, and East of them towards the old part of the works. It is a building 225 ft. in length by 113 ft. wide, and has a "weaving shed" roof, with lights on the North side only. Containing eight roads, with shallow pits, and holding 40 large engines, it is heated throughout by hot water pipes carried round the bottom of the shop and along the pits, as well as overhead. It is lighted by electricity, and ventilation is effected by straight shafts in the roof, fitted with deflectors to prevent dust falling into the shop. At one end, behind a counter, is the Shop Stores and the paint mixing machinery, which consists of 20 cylindrical mixing tanks, some putty mills, and paint grinding machines. These are driven by a motor, which also works a small air pump supplying compressed air for blow-lamps in the shop. Hand basins, fitted with hot and cold water, are provided, in order that the men may wash after work. The Spring Shop and Angle Smiths Shop adjoin each other in the old part of the works, the former being 112 ft. long by 42 ft. wide. In the centre are two coal-fired furnaces.

A motor driven spring making machine, by G. Wilkinson & Sons, taking plates from ¼ in. by ⅝ in. thick and up to 5 in. wide, shears, punches, nibs, slots and spears the plates as required for the various springs. After the springs have been built up and the buckles shrunk on, they are tested on a spring scragging machine, which straightens them out, in order that any defect in the material or temper of the plates may be revealed. This machine is motor driven, the makers being J. Buckton & Co. It will take springs up to 9 ft. long and 2 ft. 6 in. high. By means of a spring testing machine, by the same makers, the deflection of a spring for any weight up to 12 tons can be determined. There is also a hydraulic spring buckle stripping machine, by G. Wilkinson & Sons, worked by power derived from the hydraulic mains. In the Angle Smiths Shop is an angle rolling machine, by Messrs. Scriven, with four rollers, capable of taking angle iron up to 6 in. by 6 in. This is motor driven, and provided with a furnace long enough to take lengths up to 18 ft.

There are three Machine Shops. The upper and lower turneries occupy the building facing the main line, and form a continuation of part of the Offices. The shops are each 300 ft. long by 50 ft. wide. Power is derived from a 200 h.p. Robey horizontal compound condensing engine, fitted with Rowlands & Richardson's patent trip valve gear, steam being supplied from the Steam Power House boilers, which are next to the Robey engine room. The Upper Turnery is reached by a staircase, which leads into the Brass Corner. Here all brass work, such as injectors, ejectors, pumps, whistles, and boiler mountings are made and repaired. A partition divides this section from the rest of the Shop, down the whole length of which run three gangways, laid with an 18 in. gauge tramway track. The shafting overhead also extends the full length, lathes and machines being placed one either side of the gangways. These are arranged in groups, the slotting, drilling and shaping machines being seen together. Lubricant is supplied by means of an overhead tank connected to each machine, and pumped up by a small belt-driven pump from the trays.

Fitters' benches run down one side of the shop, and in one part occupy the centre for a short distance. On these benches the motion gangs work, fitting up motion for new engines, brake and spring gear,

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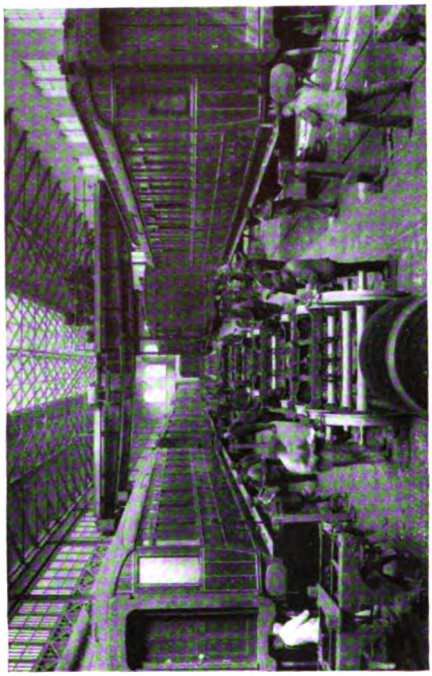
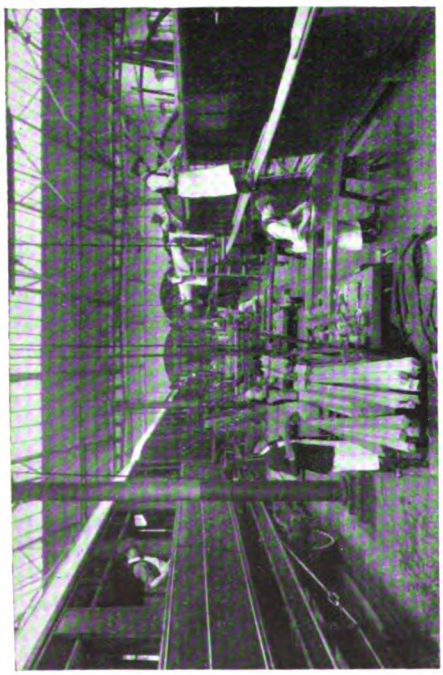


CARRIAGE REPAIRING SHOP.

WAGON REPAIRING SHOP.



CARRIAGE BUILDING SHOP.

CARRIAGE FRAME SHOP.

DONCASTER WORKS.

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etc. Beyond the benches and another partition, various bolt and pin lathes, nut facing and tapping machines, automatic and semi-automatic lathes are placed, mostly worked by boys. At the other end of the shop is the Tool Room. All tools are brought here to be ground, and by a system of brass checks the number allowed out to each man can be regulated so as to minimise loss and waste of tools. High-speed steel is nowadays used throughout the works, and a Sellars universal emery stone grinding machine enables the machine tools to be ground very accurately to any required angle and shape. There is also a "Gisholt" emery stone machine tool grinding machine, and a Sellars twist drill grinder. The latter allows of only one side of the drill being ground at once, the drill having to be turned over in order to grind the other side. This action is automatically carried out in a Meyer & Schmidt twist drill grinding machine, in which the drill is held and rotated across the face of the emery wheel, a sideways motion being imparted to the drill holder in order to give the necessary clearance. Thus both lips of the drill are accurately ground to the same angle—a most important point in twist drill grinding.

Among the machines in this shop are two "Gridley" automatic turret lathes taking steel bars up to 3¼ in. and 2¼ in. respectively. These lathes will turn pins and bolts, form knobs from round steel bar, make and tap nuts out of bright hexagon steel bar, and when once set for a job require no looking after, except to replace the bars as they are used up. An idea of the work such machines will do may be gathered from the fact that the time taken to turn a pin 1¾ in. diameter by 6¾ in. long out of steel bar is only 5 minutes. Out of hexagon bar, 1¼ in. nuts are made, faced drilled, and tapped at the rate of 30 per hour, while handrail knobs 3 in. long are turned out of 2¼ in. bar, formed and screwed in seven minutes. Three "Acme" screwing machines, screwing up to 1½ in., 2 in. and 2½ in. respectively, are worthy of special attention. In these the die-head, driven from the barrel, has a special knock-off arrangement, which can be set to open the dies when required, thus preventing over-running and damage.

As examples of work done in these machines, I may mention reversing screws 2¼ in. diameter, 1½ in. pitch treble square thread, carriage coupling screws 1¾ in. diameter, ¾ in. pitch double square thread. These are cut with a guide screw at one operation, while coupling screws 2½ in. diameter, with four "V" threads per inch, are cut at one operation without a guide screw. There is a fine 3 ft. 6 in. radial drilling machine by James Archdale & Co., which is all gear-driven, no belts being used. Fitted with ball bearings, this machine drills holes up to 1½ in. diameter, and will drill an inch hole in cast iron at the rate of 6·7 inches per minute. Among the lathes in the Brass Corner are two 8 in. brass finishers' turret lathes, by Smith & Coventry, fitted with a special chasing apparatus, two capstan lathes for brass plugs by Archdale & Co., also a 7 in. capstan lathe, with double gear headstock by the same makers; and two 10 in. facing, boring, and screwing lathes by Muir & Co. A 9 in. centre forming hollow spindle monitor lathe, with geared friction head and automatic chuck by Warner & Swasey, is used chiefly for turning, facing and boring the white metal rings for metallic packing, which are first cast in chills and finished off in this lathe.

The Lower Turnery is below the shop just mentioned, and like that, has its machine tools driven by shafting from the big Robey engine, except for a short length at the further end, which is motor driven. The machines in this shop are of a heavy type, and are arranged in groups down each side according to their designation, a standard gauge road and 18 in. tramway running the greater part of the length. At the far end of the shop cylinders are machined and fitted up ready for the Erecting Shop. Here are two radial drilling machines for drilling, tapping and studding, a port face planing machine by Craven Brothers, having an attachment for milling the edges of the ports; two horizontal double bar cylinder boring machines; and a combined cylinder and piston valve boring machine, by Messrs. Craven Brothers, having three boring bars, so that the steam chest and cylinder barrels can be bored at the same time. The steam chest boring bar may be set at any angle of inclination to the cylinder if required. Close at hand are four large planing machines, by Craven Brothers, having tables 12 ft. by 4 ft. 6 in. Two of these are motor driven, and have 6 tool boxes. Their cutting speed is 30 ft. per minute, and the return speed 72 ft. per minute. Next to these come a group of milling machines chiefly engaged in

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IN THE LOCOMOTIVE PAINT SHOP, LONCASTER WORKS.

milling the faces of horn blocks and motion plates, also connecting rods and coupling rods. These latter are done on a large horizontal milling machine by Craven Brothers, which has five table speeds and three driving speeds, the table, 12 ft. long, being screw driven. Two coupling rods are milled on the sides at the same time, the fluting and flatting being done at one operation.

Another machine that must be mentioned is a duplex boring mill by Webster & Bennett. The diameter of the tables are 36 in., and these have 16 speeds each and 6 feed speeds. Revolving dials geared to the cross slide screw and shaft are made to run in unison with the vertical and horizontal traverse, and register movements in one sixteenth of an inch. They are fitted with trip gear, which stops the traverse when the desired distance has been reached by the tools. Four eccentric straps can be bored on one of the tables at a setting, four tools working at the same time. On the opposite side of the shop are several small planing machines and a large double spindle drilling machine by Sharp, Stewart & Co., used for drilling and boring holes in connecting rods and coupling rods. The diameter of the spindles is 4 in., and the length of the bed 14 ft. 6 in., the width being 3 ft. 6 in. There are also two 4-spindle drilling machines employed in drilling brake blocks. Several small horizontal and vertical milling machines are used for motion work, and there is a horizontal milling machine fitted with a dividing head for cutting milling cutters and small gear wheels.

The third Machine Shop stands at right angles to the Turneries. Here all the machines, motor driven from shafting, are grouped as in the other Machine Shops, and served by a 6-ton walking crane down the centre of the Shop. They comprise drilling, slotting, shaping, boring and planing machines. Among the latter is a planing machine by Greenwood & Batley. This has a 12 ft. bed, and is generally used for planing axle boxes, ten being done at one time. There is also a 10½ in. centre self-acting sliding, surfacing and screw cutting lathe, with a 12 ft. bed, by Messrs. Dean, Smith & Grace. On this lathe piston valve heads and rings are turned, bored and ground. A gear cutting machine for spur wheels by Messrs. Greenwood & Batley also claims attention. This will take wheels up to 4 ft. 6 in. diameter. Next is the Metalling Shop, having six pots for melting the white metal. Here all carriage, wagon and tender brasses are metalled up on chills, which are made the correct size of the various journals, and give the necessary clearance, so that the brasses are ready for immediate use, and do not need to be machined at all. Beyond is the Grinding Shop, containing four grindstones 72 in. diameter by 12 in. wide motor driven, and a Slack's patent self-acting 6-segment-stone grinding machine.

A block of buildings adjoining these latter Shops—which in former years were used for repairing engines and tenders—are now devoted to constructing new tenders, mounting boilers, and erecting steel frames for coaches and carriage bogies. Hydraulic power is laid on in the Carriage Frame Shop,

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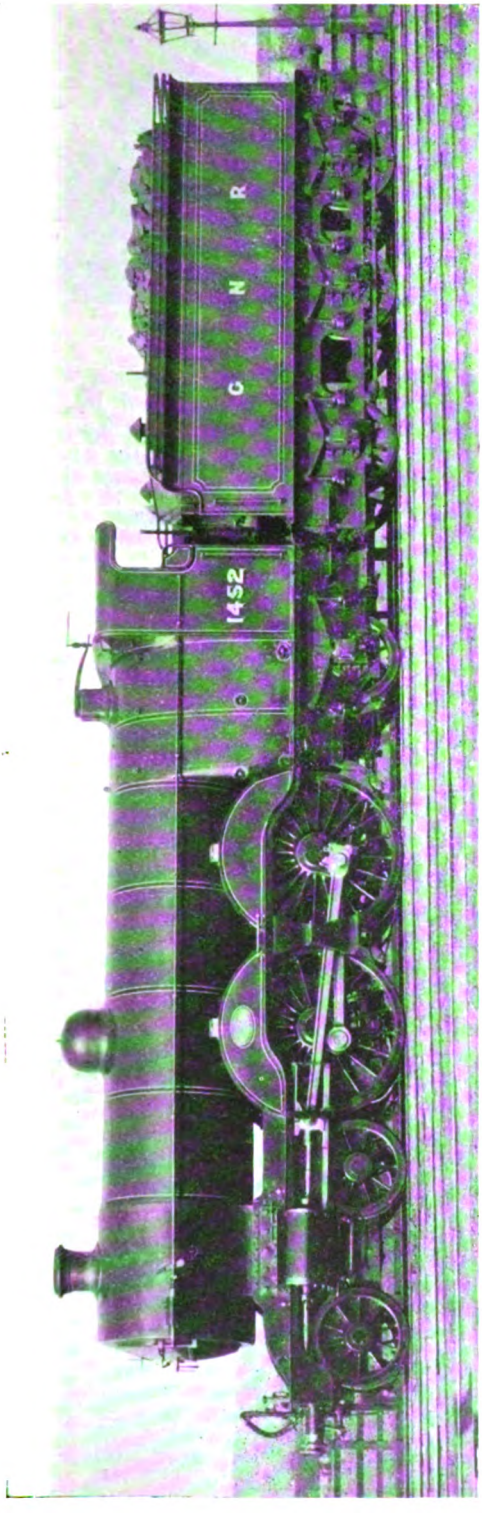

4—4—2 EXPRESS LOCOMOTIVE, WITH SCHMIDT SUPERHEATER.

and two portable hydraulic rivetters used for rivetting frames. There is also a John's patent double-ended notching machine and a John's patent angle and tee bevel cropping machine. The engine frame plate slotting machine is in a small shop adjoining. It is by Messrs. Fairbairn, Naylor & Macpherson, the bed being 36 ft. long by 5 ft. wide. It has three heads, which can both drill and slot, and takes at one time a setting of seven frame plates 1⅛ in. thick. A smaller slotting machine, with bed 29 ft. 6 in. long, two heads, is used for tender and engine bogie frames. The Engine Weigh House, close to the main line at the South end of the Works, contains an 80-ton 8-beam weighing machine, by Messrs. Samuel Denison & Son, the total length of the table being 26 ft. 6 in. All engines passing through the works are placed on this machine before being sent out into traffic, in order that the weights on their respective wheels may be properly adjusted. On the Western side, near the river Don, the Gas Works are situate. In the Retort House are 75 retorts in 15 settings, there being two sets of three condensers, two gas scrubbers, and five purifiers 10 ft. square. The 3-blade gas exhauster is driven by a small steam engine. There are three gas holders, one having a capacity of 280,000 cubic ft., and two a capacity of 45,000 cubic ft. The capacity of the gas works is about 60 million cubic feet of gas per annum.

The Carriage Works adjoin the Locomotive Works at the North end. The offices of the Carriage and Wagon Superintendent and his staff, together with the Carriage Drawing Office, are on the first floor of the building facing the main line, and are reached by means of a footbridge from the station, which also leads into the Locomotive Works. In the Trimming Shop, which forms a continuation of the Offices, female labour is largely employed in preparing the upholstery for the coaches. Opposite the bottom of the steps leading down from the footbridge the saw mill is entered. This forms the southern boundary of the Carriage Works, and is 384 ft. long by 132 ft. wide. The machinery in this Shop, as in the whole of the carriage works, is electrically driven, power being obtained from the power house in the Locomotive Works. All the large machines are driven by underground shafting, and grouped so that one motor drives three or four machines. West of the Saw Mill is the Log

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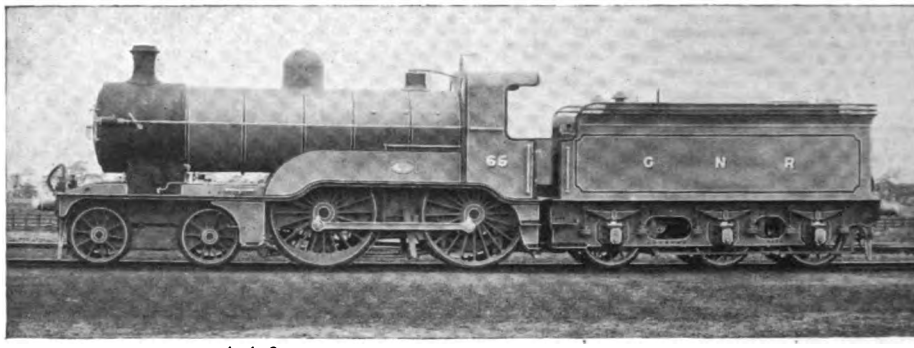

4-4-0 LOCOMOTIVE WITH SCHMIDT SUPERHEATER.

Yard. Here is an overhead 5-ton gantry crane, by Messrs. Craven Brothers, electrically driven, and used for stacking the logs until required. They are then lifted, and deposited in the end of the saw mill ready to be split up into deals and planks by the large log saws. The timber Drying Shed, North of the Log Yard, is 300 ft. by 100 ft., and fitted with louvre sides. Among the machines in the Saw Mill is a double horizontal log frame saw by Messrs. Thomas Robinson & Son, with two blades driven from cranks, which make 220 revolutions per minute. The log is placed on a rack carrier sliding on V rails, the highest feed being 4 ft. per minute. Logs up to 2 ft. square can be dealt with by this machine.

Close at hand is an upright deal frame saw, with roller feed. This has four feeds, the highest being 5 ft. per minute. There is also a 2 ft. 6 in. circular roller feed saw with four feeds, cutting 90 ft. per minute on the highest, a crosscut saw 4 ft. diameter, and an upright band saw. The saw sharpening machines are partitioned off from the rest of the shop, and here is an automatic band saw sharpener by G. D. Monninger, striking and feeding automatically, and fitted with a teeth setting attachment. There are also "Gulleting" machines for the circular saws (the teeth of which are set by hand after being ground to shape), and an automatic grinding machine for plane irons. Among the planing machines is a heavy roller feed planer by Robinson & Sons, which planes timber on all sides and takes up to 12 in. by 6 in. It has four feeds, the highest being 94 ft. per minute, the knives cutting at 3,600 revolutions per minute. There are two high speed moulding machines, one by Robinson & Sons, fitted with a horizontal disc feed, feeding from 15 to 80 ft. per minute, the knives making 3,500 revolutions per minute; and an American panel planing machine, which takes panels up to 26 in. by 7 in., the knives running at 3,800 revolutions per minute, there being five feeds, the highest 25 ft. per minute. Double spindle machines, boring, mortising and tenoning machines, and a triple drum sand papering machine by Robinson & Sons are also in use.

In the same block of buildings as the Saw Mill are the Carriage Building Shop and the Carriage Paint Shop. The former, 300 ft. long by 199 ft. wide, contains 12 roads. Here the carriage bodies are built and placed on their steel underframes, which are constructed in the Locomotive Works, and run round to this Shop on their bogies. Across the outside at the North end of both this Shop and the Paint Shop next to it, runs a 60 ft. electric traverser, by means of which coaches can be transferred from one Shop to the other. The Carriage Paint Shop, 264 ft. long by 180 ft. wide, contains 12 roads, and accommodates 44 coaches. At one side behind a counter are the Stores, with paint mixing machinery and varnish tanks. The Carriage Repairing Shop, lying to the North West of the Paint Shop along the river bank, is 593 ft. long by 182 ft. wide. It has 12 roads, four of which are used for lifting and three for the wood workers. There is accommodation in this Shop for 24 bogie coaches and 48 6-wheelers.

Two of the lifting roads, used for the heaviest coaching stock, are provided with two overhead travelling cranes, electrically driven and each capable of lifting 20 tons. In other parts of the shop lifting is done by portable compressed air jacks. At one end across the shop several machines are arranged, nearly all worked from motor-driven shafting, except four wheel lathes having separate motors, which are served by a 5-ton electric gantry crane. Here

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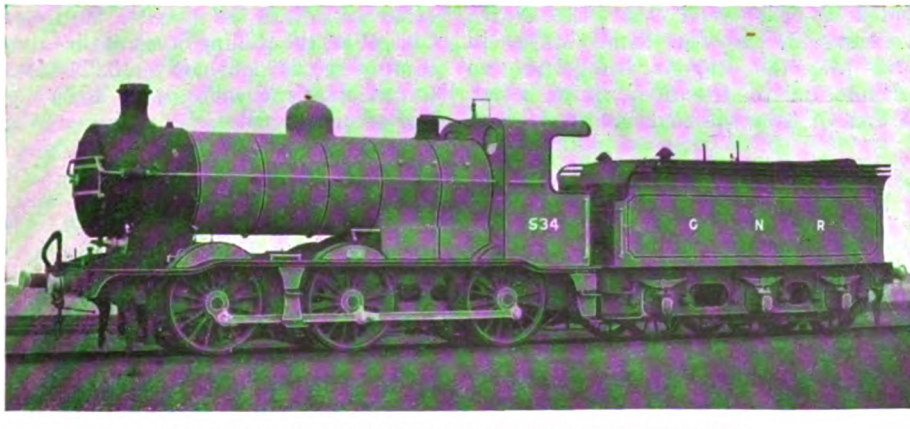
the machinery includes a 3 ft. 6 in. wheel lathe, by Messrs. Craven Brothers, driven from the centre through gearing by a 35 h.p. motor. This lathe turns out one pair of wheels per hour. There are also two double-ended axle lathes, a double-headed journal skimming and burnishing machine, three double-head tyre boring and two single-head wheel boring machines and two wheel balancing machines, one worked by a rope round the tread of the wheel, the other by a clutch gripping the end of the journal. A hydraulic wheel press, by Messrs. Craven Brothers, exerting a pressure up to 200 tons on the ram, is fitted with an automatic pressure recorder. A smaller hydraulic wheel press tests all axles after the wheels have been pressed on to them, the maximum pressure of the machine being 50 tons. There is also a vacuum brake testing apparatus, similar to that in the Tender Shop. Some distance across the yard, at the extreme Northern end of the Works, is the North Carriage Shed. This has eight roads, and is 380 ft. long by 110 ft. wide. Here the coaches of the Royal Train are stabled. Washing, varnishing, and slight repairs are carried out in the same shed. Besides the construction and repairing of the Great Northern Railway coaching stock, some of the East Coast Joint Stock coaches and Cheshire Lines Committee stock are built and repaired at Doncaster.

As before stated, the Wagon Works are situate 1¾ miles South of the station, on the down side of the line. There being no houses in the vicinity, a special train runs every morning and night from and to the passenger station, for the purpose of conveying the workmen to the shops. A mess room, 98 ft. long by 73 ft. wide, is provided, fitted with all the necessary cooking and washing up apparatus, and over 500 men can therein be accommodated for meals. Power is derived from a Crossley suction gas plant of 350 h.p. capacity, run entirely off wood chips and refuse, which are drawn from the wood-working machines by a Simons suction apparatus, and delivered into a hopper close to the gas producer, then to be lifted by bucket conveyors up to the charging platform. Two 150 h.p. gas engines are run off this producer. One of these is a horizontal single cylinder Crossley engine, running at 170 revolutions per minute, and the other a 4-cylinder vertical Campbell engine, running at 250 revolutions per minute. Both engines are directly coupled to the generators. At the time of writing another 350 h.p. suction plant and 4-cylinder vertical engine is in process of erection by the side of the present plant.

All the Shops lie parallel to the main line. The North Wagon Shop, 745 ft. long by 231 ft. wide, contains seven working roads 524 ft. long, and has accommodation for 140 wagons. It is used only for the construction of new wagons. On the Western side and at the South end is erected the machinery, which includes a large roller feed planing machine by Messrs. A. Ransome & Co., and a smaller planing machine by the same makers, a triple crosscut saw and a cross-cut saw bench, with worm feed. There are also multiple drilling machines and boring and mortising machines. The South Wagon



SIX-COUPLED GOODS ENGINE WITH SCHMIDT SUPERHEATER.

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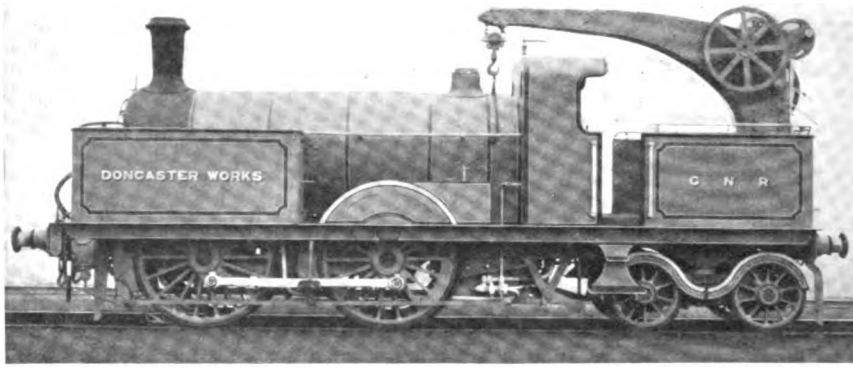
Shop, 525 ft. long by 231 ft. wide, is separated from the North Shed by an open space. This Shop, used for repair work, contains 15 roads, 10 of which are working roads, and it has accommodation for 220 wagons. The Road Goods Shop, in which are built drays, vans, and other road vehicles, is 250 ft. long by 105 ft. wide. This Shop lies between the South Wagon Shop and the main line, while just South of it is the Paint Shop, 210 ft. long by 105 ft. wide. The Grease Factory, a little to the south of the Paint Shop, contains boiling vats and cooling tanks for the manufacture of wagon grease and soap for carriage cleaning.

The Engine Sheds are a mile South of the station, on the up side of the line, and arranged on the double-ended system, coal stages and turntables being provided at each end. At the North end, elevated, is the coal stage in general use, the wagons being run up an incline on to the floor, from which by means of tubs the coal is tipped on to the tenders. The Shed itself, containing 12 roads, is constructed on the through road principle, and has stabling room for 96 engines. Adjoining the Shed is the Lifting Shop, with overhead crane, and a small Machine Shop leads therefrom, together with a Smiths' and Coppersmiths' Shop. The Stores are on the same side of the Shed, near the North entrance, and outside is a double storey building. On the ground floor are the offices, and above a large lecture room for the Enginemen's Mutual Improvement Society. The Oil Gas Works are to the South of the Engine Shed, the output being 12,000,000 cubic ft. per annum. Mains are laid from these works up to the station and along the various carriage sidings for the gassing of coaches. Travelling gas tanks are charged here and worked away to gas coaches at other stations in the district. On December 31st, 1912, the Rolling Stock of the Company comprised 1,279 locomotives, 3,233 carriages, 6 rail motor coaches, and 40,519 goods and service vehicles.



STIRLING TANK ENGINE FITTED WITH 5-TON CRANE FOR USE ABOUT THE WORKS.

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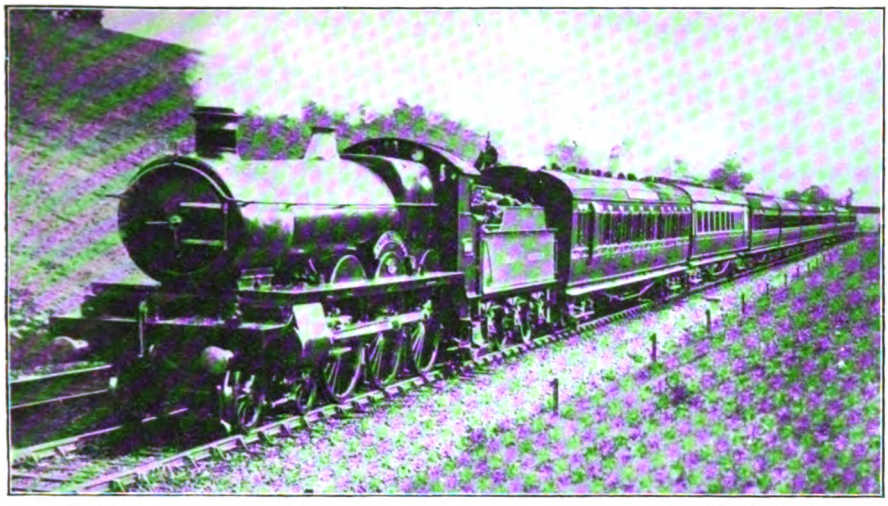

Photo] [*F. E. Mackay.*

GREAT WESTERN RAILWAY: TWO-HOUR BIRMINGHAM EXPRESS.
Locomotive No. 2929 *Saint Stephen.*

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

A BRIEF examination of letters received from correspondents during recent months reveals such a wealth of reference to the Great Western Railway that I am compelled to devote to them a month's contribution. One of the most surprising features of the runs forwarded to me is that in almost every case they have been supplied by enthusiasts living at points remote from the Great Western system proper, as, for instance, Scarborough, Preston, and even Canada. Mention of Canada reminds me of communications recently to hand from three correspondents in the Dominion, accompanied by others in connection with these articles from Paris, Madrid, Frankfort, and Port Sudan (Suez Canal). It speaks volumes not only for the world-wide circulation of the RAILWAY MAGAZINE—which is indisputable—but also for the fascination exercised by British locomotive design and work, that subjects of this kind attract the keen interest of those living so far from British shores. There seems to be an indefinite "something" about our express train services that is not yet, at any rate, found in other countries. Whether it be the "sporting" character of many of the high-speed bookings over heavily graded roads which invests such runs with excitement from start to finish, or whether it be the brilliant work of comparatively small locomotive types with heavy trains—to name but two characteristic features of British performance—it is difficult to determine. But certain it is that most of us would be loath to exchange the attractions of locomotive running in this country for those afforded abroad.

The first-mentioned characteristic of British working is present to a marked degree on the Great Western Railway. On such a service as that in operation between London and Birmingham over a 110¾-miles' route, for example, a schedule of 2 hours by a none too easy road, with loads at times fairly heavy, needs enterprising locomotive work when an intermediate stop, and in one case two stops, are included in the booking, in addition to several severe service slacks. The same might be said of the 3-hour service between London and Exeter, 173¾ miles, over a route in parts decidedly difficult, with three bad slacks, and loads sometimes attaining, during the summer season, to between 400 and 500 tons. It may be urged that, to meet such conditions, the cost of the locomotive department errs on the expensive side, particularly

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in respect of boiler maintenance with so high a working pressure as 225 lbs. per sq. in., which is in this country a quite exceptional figure. On the other hand, however, such a provision has furnished the Great Western Company with locomotives capable of almost any possible feat of haulage, rendering pilotage with heavy loads unnecessary, and also affording a power reserve for regaining all reasonable losses of time due to signal and permanent way delays encountered *en route*. One is, perhaps, rather at a loss to understand the duplication of wheel arrangements such as is found in the inside and outside cylinder 4–4–0's and the 2-cylinder and 4-cylinder 4–6–0's. It is true that the 30-inch stroke engines are confined generally to switchback routes, where their free downhill running and the leverage of their long stroke are of most value; whereas the inside cylinder 4–4–0's and the 4-cylinder 4–6–0's expend most of their efforts on those portions of the line where more constant "pulling" is needed. Even then, however, the actual work performed is very similar.

As I have here mentioned the 2-hour Birmingham service, I begin with a description of four runs of which I was fortunate enough to secure recent records. The first train was the 9.10 a.m. down, calling at High Wycombe, and slipping three coaches —at Princes Risborough, Banbury and Leamington respectively—thus adding a third to the existing two trains (the 10.30 a.m. Riviera express and the 4 p.m. Birmingham express) on which the same is done without intermediate stoppage. Headed by the 2-cylinder 4–6–0 No. 2902, *Lady of the Lake*, we had a total load from the start of 275 tons—nine eight-wheelers in all—reduced at Risborough to 250 tons, at Banbury to 220 tons, and at Leamington to 190 tons. The usual severe slack was made at Old Oak Common, and the recovery beyond was comparatively slow, so that we took 14½ min. to pass Northolt Junction, 10⅛ miles out. Only 4 min. 40 sec. were occupied over the 4⅝ miles to Denham, and the speed up the ensuing 6⅞ miles to Beaconsfield—mostly inclined at 1 in 175 and 1 in 264—was so good that this distance took only 7½ min. With a smart finish, on which a maximum of 69·2 miles per hour was touched, High Wycombe, 26½ miles, was reached in 31 min. 50 sec. from the start, or nearly 2 min. behind time.

Starting again with the same 2 min. arrears, the 5 miles, beginning at 176 and finishing at 164, to Saunderton—the scene of recent Suffragist "attentions," which, by the way, had occurred the previous night—were covered in the remarkable time of 7½ min., the train accelerating to 51·1 miles per hour up the 1 in 164. Consequently, Risborough, 8⅛ miles, was passed in 10 min. 50 sec. from Wycombe, which is the best time I have yet recorded by this train. From the latter point the speed down the falling grades was moderate, not exceeding a maximum of 73·8 miles per hour, although, after the usual careful slack for Ashendon Junction, 76·3 miles per hour was attained in the neighbourhood of Brill, beyond which town the average ranged from 60 to 70 miles per hour without a break as far as Leamington. From Risborough to Bicester the 18⅞ miles occupied 17¼ min., the 14 miles thence to Banbury 13 min. 10 sec., and the 13½ miles from Banbury to Southam Road, 12½ min. Thus we had improved on "even time," having without excessive speed at any point covered the 54½ miles from Wycombe start to Southam Road in 53¾ min. As usual, we came very slowly down Southam Road bank, and at quite a "crawl" through Leamington, passing that town in 60¾ min. from Wycombe (60¾ miles), or in 93 min. 40 sec. from London inclusive. Recovering with our now reduced load of 190 tons at a leisurely pace up the Hatton bank, we passed Widney Manor, 14¾ miles further—nearly all uphill—in 16 min. 10 sec., but then encountered two exceedingly bad checks for bridge repairs in succession, each to a walking pace, followed by a string of signal checks, which together caused the last 8¾ miles into Snow Hill to consume 12½ min. Thus the total time from London was 122 min. 20 sec. gross, but certainly not more than 119 min. net (including Wycombe stop). The total time from High Wycombe was 89 min. 25 sec. inclusive—only 25 sec. more than that scheduled—or 86 min. net for the 84¼ miles.

The second down journey was by the 2.35 p.m. down express, which, so far as performance goes, is a less notable train, in that it is usually lighter and also scheduled as non-stop. On the run in question we were fortunate enough, however, to make two stops, and yet to keep time. No. 2906, *Lady of Lynn*, was our engine, with a load of eight eight-wheelers, one to be slipped at Banbury and two at Leamington, giving loads of 250, 220 and 165 tons for the successive stages of the journey. Soon after starting we were stopped dead at Old Oak Common in order to allow an up train to pass on the slow line, and so took

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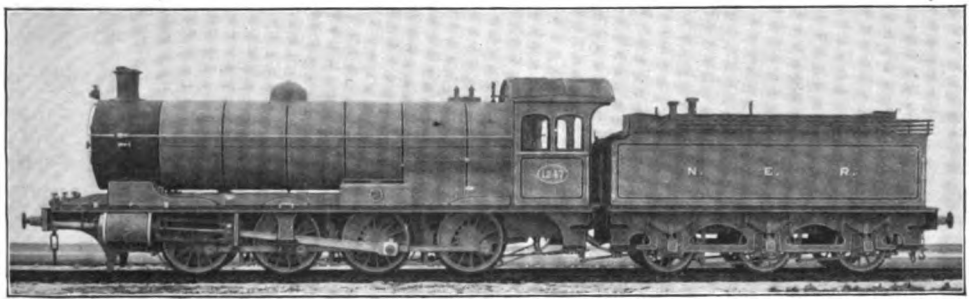
16 min. 25 sec. to pass Northolt. But this was followed by a wonderful ascent to Beaconsfield, the ensuing 11½ miles taking only 11¼ min. Thus despite the stop Wycombe was passed in 32 min. 5 sec., and Risborough, 34⅝ miles out, in 42¼ min. On the succeeding bank the maximum speed was 75 miles per hour, the time taken from Risborough to Bicester being 17¼ min. (as in the previous run) from Bicester to Banbury 13 min. 50 sec., and from Banbury to Leamington, 19¾ miles, 18¼ min. Down Southam Road bank the speed was much faster, touching a maximum of 79 miles per hour, so that we passed Leamington in 91 min. 35 sec. from London, stop inclusive, 91 min. 10 sec. running time, and 89½ min. net. With a load of only 165 tons remaining, an excellent ascent was made of Hatton bank, Hatton, 6 miles from Leamington, being passed in 7 min. 5 sec., and Widney Manor, 8¾ miles almost entirely uphill, although over easier grades, by an astonishing spurt in a further 7¾ min. With 4 or 5 min. in hand—although on this run stopped dead for the first bridge renewal and slowed to a "crawl" for the second—we finished easily at Snow Hill in 119¼ min. from the start, 118 min. 40 sec. running time, or 113 min. net. This was a very fine run.

On the first up journey I was pleased to make the acquaintance, for the first time as far as timing is concerned, of the pioneer of the French compounds, No. 102, *La France*, which gave me a run that I am not likely to forget. The train was the 12.13 p.m. *ex*-Birmingham, with the fair load of ten eight-wheelers from the start, including luncheon car, of which one was slipped at Hatton, and three detached at Leamington, giving successive loads of 300 tons, 275 tons and 185 tons respectively. A smart start was made, Olton, 5½ miles, being passed in 7 min. 25 sec. The two bridge checks caused the next 5¼ miles to Knowle to occupy 6 min. 55 sec., after which the 10¾ miles down to Warwick were covered in 9 min. 40 sec., with a maximum of 76·3 miles per hour on Hatton bank. Thus we reached Leamington, 23½ miles, in 26½ min., or barely 25 min. net. The start from Leamington witnessed a fine performance, although with a light load. A maximum speed of 55 miles per hour was attained up the continuous 1 in 187 of Southam Road bank with 185 tons, taking us past Southam Road station, 6¼ miles, in 8 min. 25 sec., while the succeeding 5 miles to Fenny Compton, also inclined uphill, mostly at 1 in 239 to 1 in 256, were covered in 4 min. 50 sec.



NEW SUPERHEATER MINERAL LOCOMOTIVE: NORTH EASTERN RAILWAY.

Designed by Mr. V. L. Raven, Chief Mechanical Engineer.

Cylinders, 20 in. by 26 in.; coupled wheels, 4 ft. 7¼ in. diam.; steam pressure, 160 lbs. per sq. in.; grate area, 23 sq. ft.; wheelbase, 17 ft. 2 in. The boiler is 5 ft. 6 in. diam., and 15 ft. long in the barrel, while the firebox is 8 ft. long.

Some fast running then began. The 8½ miles from Fenny Compton to Banbury occupied 8 min. 5 sec., and the 14 miles thence to Bicester 13 min., including a slight slack at Aynho Junction, and a minimum speed of 55·6 miles per hour at Ardley tunnel. Through Bicester we attained a maximum of 77·5 miles per hour, and at Brill, 39¾ miles from Leamington, we had improved on "even time" with a total time of only 39 min. 20 sec. Slacking for Ashendon Junction, the 12⅞ miles on to Risborough took 12½ min., and the 8⅛ miles thence to Wycombe—passed very cautiously—8 min. 40 sec. *La France* recovered finely, breasting the 4⅞-mile rise to Beaconsfield—mostly at 1 in 225—in 5¼ min. Afterwards followed the speed exhibition of the journey, the 17⅛ miles from Beaconsfield to Park Royal being covered in 13 min. 35 sec., with

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a sustained maximum of 86·5 in the neighbourhood of Denham. Park Royal, 82¾ miles from Leamington start, was thus passed in 79 min. 20 sec., and finally, after the usual string of checks, rather less severe than usual, Paddington was reached in 86½ min. exactly for the 87¼ miles, start-to-stop, 4½ min. under schedule time. Our gross time from Birmingham, with the bridge checks and the 2½ min. stop at Leamington, was 115½ min., actual running time 113 min., and the equivalent net non-stop time something decidedly under 110 min.

In the evening of the same day I recorded another performance of sterling merit on the 4.50 p.m. *ex*-Birmingham behind a 4–4–0 "County"—a type of engine which I have never previously timed on a first-class express of this character. True, the load was light throughout, consisting only of 130 tons, but *two* stops have to be made, one at Leamington and the other at Banbury, only 67 min. being allowed (according to the public time-book) to cover the 67½ miles from the latter point to London. I wonder how many "Bradshaw" students have noticed this fresh addition to the limited number of "mile-a-minute" runs! Starting well, No. 3829, *County of Merioneth*, equalled *La France's* time to Olton, but slacked more cautiously over the bridges, taking 7 min. 35 sec. on to Knowle, and then ran into Leamington, 12¾ miles, in a further 12¾ min. exactly, total 27¾ min. The maximum speed on Hatton bank was only 70·3 miles per hour. To my mind the most startling exhibition was up Southam Road bank, the times from Leamington start to Southam Road being 7 min. 55 sec., and to Fenny Compton, 12 min. 35 sec. The 11¼ miles to the latter point are all uphill, including a mile at 1 in 202 at the start, 3¼ at 1 in 187 to Southam Road, and 3 averaging 1 in 241 to 1 in 256 to past Fenny Compton.

From Fenny Compton to Banbury stop the 8½ miles took only 8 min. 55 sec., giving the very smart time of 21½ min. for the 19¾ miles Leamington to Banbury, start-to-stop. At Banbury we had to wait for time, losing thereby at least 2 min., which might with advantage be added to the very "tight" schedule beyond. A good start was again made from Banbury, the 14 miles to Bicester, including the ascent from Aynho Junction to Ardley tunnel, occuping only 15 min. 25 sec. Past Bicester speeds of 80·3 and 81·8 miles per hour were recorded over a number of quarter-miles, so that at Brill, 20 miles from Banbury, we had touched "even time" all but 10 sec.; but the speed fell off somewhat on the rising grades from Haddenham. Consequently the time from Bicester to Risborough was 18 min. 25 sec., and from Risborough to Wycombe 9 min. 35 sec. The same recovery as on the previous run followed from Wycombe slack to Beaconsfield, 5 min. 20 sec. being taken for this length, and also a similar "lightning" speed beyond, with the same sustained maximum—86·5 miles per hour—although the time for the 17⅛ miles to Park Royal on this run was 14 min. 5 sec. Park Royal was passed in 62 min. 50 sec. from Banbury, 63 miles, and with a clear road we might have effected an arrival in 69 min., but several very severe checks, with a stop at Royal Oak, made the time 72 min. 35 sec. The total time from Birmingham was thus 126 min. 35 sec. Allowing for the bridge and signal checks, it would be about 121 min. net, or less the 2 min. overtime spent at Banbury, 119 min. net only, with two stops. This, it will be admitted, was very fine work for a 4–4–0 engine, and I had no idea that the "Counties" were such speedy machines. These journeys will give a good idea of what is being performed daily on the Great Western route to Birmingham. It is a journey of unusual interest to the "timist," being always full of incident throughout.

I now turn to the experiences of my correspondents, which seem to cover not only every type of express engine in use on the Great Western Railway, but also every section of that company's system other than that just dealt with. In the first place, I have before me a log, supplied by a Preston friend, of a run on the 4.30 p.m. 2-hour (Sunday) express from Paddington to Bristol *viâ* Badminton, with a very heavy load of two twelve-wheelers (a dining and a sleeping car, both empty stock), 10 eight-wheelers, of which one was a 70 ft. restaurant car, and a further six the largest 70 ft. corridor vehicles, together with a horse-box. This total load of 54 axles could not have weighed with passengers less than 425 tons behind the tender, and was hauled by the 4-cylinder 4–6–0 No. 40 (now 4000) *North Star*. According to Great Western standards, the start was moderate, 14 min. 28 sec. being occupied over the first 9 miles to Southall, but the mile-a-minute rate was attained at this point, and the next 9½ miles to Slough covered in 9 min. The ensuing 17½ miles to Reading, practically all up the almost imperceptible 1 in 1,320, were covered in 16

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min. 19 sec.; the further 17 miles to Didcot, at much the same inclination, in 15¾ min., while the 24¼ miles from Didcot to Swindon, largely inclined at 1 in 764, occupied 23 min. 28 sec., giving a total time of 79 min. for the 77¼ miles. From Swindon to Wootton Bassett, where the usual slack was made for the South Wales line, the 5¾ miles took 5 min. 16 sec.; the 17 miles from the latter point up to Badminton 17 min. 41 sec.; and the 9¾ miles thence down to Winterbourne 8 min. 35 sec. As customary, the last 8 miles into Bristol were taken with great caution, observing the service slacks, and occupied 10 min. 14 sec., giving a total of 120 min. 46 sec. for the 117½ miles' journey. This was a wonderful exhibition with so heavy a load, the excess of less than a minute on schedule time being scarcely worth mentioning. The time of 69 min. 48 sec. for the 74 miles from Southall to Wootton Bassett, all a fraction "against the collar," would with a load of 425 tons need a good deal of beating.

An up journey by the same route, for notes of which I am indebted to another friend, loses a good deal of its virtue in view of the fact that the load was only 240 tons: the engine in this instance was a 2-cylinder 4–6–0 *Robins Bolitho*. A smart start was made to Filton, only 9 min. 10 sec. being taken for the 4¾ miles to this point, the last two of which are inclined at 1 in 75, but thence to Badminton the speed fell off, this 12¾ miles taking 14 min. 47 sec. From Badminton down to Wootton Bassett, where a slight slack was made, the time taken was 15 min. 57 sec. (17 miles), and from Wootton Bassett to Swindon, 5¾ miles, 5 min. 38 sec. This initial 40¼ miles had thus occupied 45 min. 32 sec., and the remainder of the journey was therefore easy. The 24¼ miles from Swindon to Didcot were reeled off in 20 min. 34 sec.; the 17 miles thence to Reading in 14 min. 42 sec., the fastest work on this length being performed between Wantage Road and Pangbourne, where for 19 miles an average of nearly 73 miles per hour was maintained. At Reading "even time" had been improved on, the 81½ miles from Bristol having been covered in 80 min. 48 sec. The driver therefore eased down, taking 17 min. 23 sec. on to Slough (17½ miles) and 9 min. 40 sec. thence to Southall, 9½ miles. Beyond Southall, however, on account of this being the last evening of Henley Regatta, some severe checks were experienced past Acton, so that, although time was well in hand, the total to the stop at Paddington was 123 min. 33 sec. The net time, however, was 118 min. only for the 117½ miles, and this could have been greatly improved at various points had high speed been necessary.

Photo] [*F. E. Mackay.*

GREAT WESTERN RAILWAY: UP WEYMOUTH EXPRESS.

Locomotive No. 3376 *Herschell.*

A down run from London to Bath by the 4.15 p.m. express, supplied by the same friend, is principally important in that the engine was a 2-cylinder "Atlantic," with a total load of 12 eight-wheelers of various patterns, including a dining car, or 375 tons in all. The start was more brisk than that of the down Bristol run, only 12 min. being taken to Southall. But this was

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not followed by such high speed beyond. The 9½ miles from Southall to Slough took 9 min. 19 sec.; the 17½ miles Slough to Reading 17 min. 7 sec.; the 17 miles Reading to Didcot 16 min. 29 sec.; and the 24¼ miles Didcot to Swindon 25 min. 35 sec. This gave a total of 80½ min. for the 77¼ miles to Swindon. Some fairly high speed was registered on the falling grades between Swindon and Chippenham, this 16¾ miles being covered in 15 min. 3 sec. The 8 miles thence to Box occupied 7 min. 57 sec., and the last 5 miles into Bath 5 min. 49 sec. This gave a total start-to-stop time of 109 min. 19 sec. for the 107 miles from Paddington to Bath, or 1¾ min. less than that scheduled, and represented smart work for an engine of this type with a heavy train.

Some idea of the speed achievements on excursion trains of the Great Western Railway is afforded in a log of a run on one of the half-day trips to Weston-super-Mare, as forwarded to me by a young reader of the RAILWAY MAGAZINE. With the 4-cylinder 4–6–0 No. 4018, *Knight of the Grand Cross*, and 11 eight-wheelers of mixed stock —about 330 tons in all—Slough, 18½ miles, was passed in 22 min. 56 sec. from Paddington; Reading, 36 miles, in 39 min. 34 sec.; Didcot, 53 miles, in 55 min. 44 sec.; Swindon, 77¼ miles, in 81 min. 17 sec.; and Chippenham, 94 miles, in 97 min. 4 sec. From this point delays supervened, but to cover the 75½ miles from Slough to Chippenham in 74 min. 8 sec. when travelling on a cheap half-day excursion train, as was done on this occasion, is a decidedly novel experience.

A friend in Scarborough has supplied details of a "return journey" from Bath, in the form of a trip with one of the "Flower" type of inside cylinder 4–4–0 engines, on the 9.28 a.m. express from that city. With a schedule as easy as 117 min. for the 107-mile journey, and a load of only 190 tons, the engine was faced with no difficulties had it not been for the checks encountered *en route*. As with the "County" run previously given, the start was smart, Box, 5 miles, being passed in 7 min. 10 sec., and Chippenham, a further 8 miles, in another 9 min. 10 sec., despite the 2 miles rise at 1 in 100 through Box tunnel. Shortly afterwards came the first check—a dead stand for 2 min. at signals—but on restarting the engine accelerated to 56·2 miles per hour up the continuous 1 in 660 to Dauntsey. Thus it took 21 min. 55 sec. to cover the 16¾ miles from Chippenham to Swindon. Attaining a maximum of 66·1 miles per hour after Swindon, the 24¼ miles thence to Didcot were covered in 23 min. 50 sec. Despite a second severe check beyond Shrivenham, the 17 miles from Didcot to Reading occupied 16¼ min., and the 17½ miles from that point to Slough 15 min. 55 sec., making the gross time for the 88½ miles from Bath to Slough 94¼ min. A permanent check near Langley, a severe signal check at Ealing and a very slow approach to Paddington combined to make the last 18½ miles take 22 min. 32 sec., but even then the train arrived 13 sec. inside schedule time, having covered the 107 miles in 116 min. 47 sec. gross, or not more than 108 min. net, at the most modest estimate of delay.

A Finchley correspondent has supplied me recently with details of a run on the Cornish "Riviera Limited" express, which demonstrates the remarkable reserve power of the 4–6–0 engines in regaining time lost through delays *en route*. The gentleman in question was travelling in the Taunton slip coach, and his log therefore terminates at that point, although all the lost time had then been regained. With passengers, the load amounted to about 330 tons to Westbury, and 295 tons beyond to Taunton. Starting moderately, Ealing, 5¾ miles, was passed in 9 min. 5 sec.; Slough in 20 min. 55 sec.; and Reading (at 20 miles per hour) in 37 min. 50 sec. Reading service slack was followed by a further severe check for relaying west of the station. Consequently the 5¼ miles from Reading to Theale occupied 6 min. 50 sec., but wonderful work followed up the rising grades to Newbury, the 12¾ miles taking only 11 min. 35 sec., although including 1¼ miles at 1 in 250, and 2½ at 1 in 450. A severe signal check at Kintbury followed. Despite this, the 17 miles from Newbury to Savernake were covered in 18 min. 55 sec. The last 3 miles to the summit are inclined at 1 in 180 and 1 in 144. Down to Westbury the speed was not excessive, but outside the station alterations to signalling compelled a momentary stop, and a long "crawl" into the platform, where the Weymouth coach was detached. This 95½-mile journey had taken 99 min. 20 sec., or not more than 95 min. net. For some reason a stop of 3¼ min. duration was made, so that the start was 5¼ min. behind the booked passing time, but the work thereafter was really brilliant. The 5¾ miles up to Frome (including 1½ at 1 in 151), where the usual 30 miles per hour slack was made, occupied

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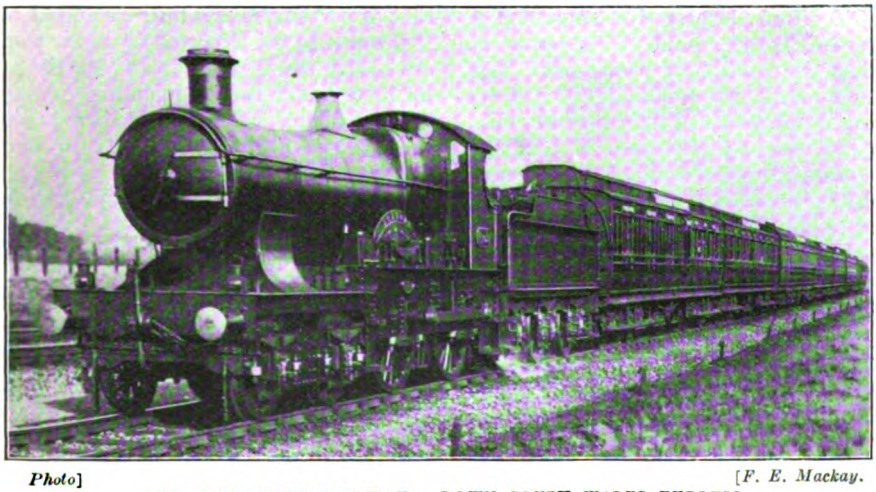
8 min. 20 sec.; and the 14 miles thence over "mile-post 122¾" summit to Castle Cary 14½ min. It was, however, over the easy stretch from Castle Cary to Taunton that the engine showed her mettle, covering this 27¾ miles in about 24 min., seeing that the slip coach came to rest at the far end of the platform in 24½ min. exactly from passing Castle Cary. Thus the total time from London was 149 min. 55 sec. for the 143 miles, although certainly not more than 141 or 142 min. net, including as it did one permanent way check, one permanent way momentary stop, one severe signal check, and the 3¼ min. stop at Westbury. The start-to-stop time from Westbury to Taunton, 47½ miles, was one of 47 min. 20 sec., showing a gain of 5 min. 10 sec. on the scheduled pass to stop time.

at 25 miles per hour, took 5¾ min., and then the 3⅞ miles to Dainton Box, which includes successive half-miles at 1 in 97, 57, 47 and 43, were completed in 6½ min. A very moderate speed ensued to Totnes, the 4¾ miles, beginning with an equally steep 2-mile descent, taking 5 min. 3 sec. Immediately following is the steep climb to Brent, starting with a mile at 1 in 64-71, and continuing with ¼ at 48, 1¼ at 51, 1¼ at 90, ¼ at 63, and ½ at 125, with easier subsequent grades. This 6 miles occupied 11 min. 23 sec. The last 2⅛ miles up to Wrangaton summit (at 220, 254 and 132) took 2 min. 37 sec., and the falling 6⅞ miles thence to Hemerdon Box were covered very gently in 7 min. 18 sec. A higher speed was, however, attained down Hemerdon bank. Mutley, 6⅞ miles from Hemerdon, was passed in a further 6



Photo] [*F. E. Mackay.*

GREAT WESTERN RAILWAY: DOWN SOUTH WALES EXPRESS.

Locomotive No. 4109 *Lobelia.*

A similar, although yet more remarkable recovery on the same train—in this instance over the hardest section of the whole journey, from Exeter on to Plymouth—is recorded in a letter from a friend in Canada. The train passed Exeter 8 min. late, but with a reduced load of 210 tons, the 4-cylinder 4–6–0 No. 4013, *Knight of St. Patrick*, made a wonderful effort to regain the arrears. Recovering smartly from the 20 miles per hour slack through St. David's station, Exminster, 4¾ miles, was passed in 5 min. 8 sec., and, with a maximum speed of 69·2 miles per hour at Starcross, Teignmouth, 15 miles, in 14 min. 50 sec., although scheduled 18 min. The 5¼ miles from Teignmouth to Newton Abbot, which was passed

min. 24 sec., despite the 1¼-mile rise at 1 in 80 at the finish, while North Road, Plymouth, was reached in another 27 sec. This gave a total time of 60 min. 37 sec. for the 52 miles from Exeter, against a booking of 67 min.

My correspondent calls attention to this as the best published run he has ever seen between Exeter and Plymouth, and I have, therefore, for the purpose of comparison, referred to the details of the record run made by the 4–4–0 engine No. 3433, *City of Bath*, with the royal train on July 14, 1903. On that occasion the load was only 130 tons, and the time from Exeter to Plymouth 61 min. 1 sec.—24 sec. longer. The running on the latter occasion, however,

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was really much finer, as the station slacks and downhill stretches were negotiated with the most scrupulous moderation, in view of the distinguished personages on board. Thus Exeter to Exminster took 5 min. 58 sec., and to Teignmouth 17 min. 41 sec.—a clear difference of 2 min. 51 sec. Teignmouth to Newton Abbot took 5 min. 36 sec., but the ascent to Dainton was made in 5 min. 37 sec., against the 4–6–0's 6½ min. To Totnes the rate was again slower—5 min. 18 sec. against 5 min. 3 sec.—but up Rattery bank to Brent very much faster, only 9 min. 26 sec. being consumed as compared with the 4–6–0's 11 min. 23 sec. Brent to Wrangaton took 2 min. 33 sec., and Wrangaton to Hemerdon 7 min. 39 sec.—again slower—although the final sprint into Mutley was for once equal, taking only 6 min. 23 sec. Had the 4–4–0 engine copied the times of the 4–6–0 from Exeter to Teignmouth, Dainton to Totnes, and Wrangaton to Hemerdon, the total time would have been only 57 min. 34 sec., making the 4–4–0's time considerably the better of the two. Judging by the earlier stages of the run, such a proceeding would have been more than easy. However, I should not wish in the least to throw discredit on the very fine work of the 4–6–0 engine, which, after all, was accomplished in ordinary every-day performance, and effected a saving of nearly 6½ min. on schedule over the hardest section of the journey.

My Canadian friend mentions another remarkable run beyond Plymouth, on one of the well-known "Sunrise to Sunset" Cornish Riviera trips, which furnishes a further instance of the manner in which the Great Western Railway Company caters for the excursionist. The train left North Road with a load of 210 tons, hauled by one of the small-wheeled 4–4–0's, No. 3363, *One and All*, 14 min. behind time. On reaching Par, the first stop, 12½ min. of the arrears had been regained, the 35 miles to this point, with the single line working checks, and the appalling gradients, having consumed only 59 min. 25 sec. For the 12 miles from St. Germans to Doublebois, almost entirely uphill and including miles at grades from 1 in 60 to 70, the time of 17 min. 21 sec. strikes me as especially fine. The unbroken climb from Par to Burngallow, 7 miles virtually all at the same inclination, took 16 min. all but 2 sec., and Truro, 19 miles, was reached in 30 min. 10 sec. from Par as scheduled. Time was lost from Truro to Gwinear Road—another section of truly fearsome grading—this 15¼ miles taking 26 min. 7 sec. instead of 25 as booked; but by covering the last 10½ miles from Gwinear Road into Penzance in 18 min. 27 sec., an arrival almost 2 min. early was effected. Thus a total of 16 min. was gained on scheduled time, although 2 of these were due to time economised at stations. At any rate, the sterling character of the run will be appreciated when it is mentioned that with only one stop less, the the time showed an improvement of 10 min. on the schedule of the Riviera express between Plymouth and Penzance.

A return journey, of which details are supplied by another correspondent, deals with the 1.15 p.m. express *ex*-Penzance, loading to 167 tons from the start, and 221 tons from Par, hauled by another engine of the same type—No. 3369, *Trelawny*. Presumably these are the coach-weights without that of passengers and luggage added. From Penzance to St. Erth the 5½ miles took 10½ min., and the 5 miles from St. Erth start up to Gwinear Road—including a mile at 1 in 59—10 min., which showed some excellent work. The Gwinear Road-Truro run was spoiled by a 4-min. signal stop outside Chacewater, but was accomplished in 31 min.—4 min. over the booked time for 15¼ miles. From Truro to St. Austell, 14½ miles of formidable undulations up to 1 in 65 and 70, mainly rising, 23¾ min. were taken instead of 26, as booked, while the 4½ miles from St. Austell to Par, start-to-stop, occupied 6 min. 55 sec. With the increased load from Par, the 17 miles to Liskeard, including the 7-mile bank to Doublebois at 1 in 65 to 1 in 90, were covered in 32 min. 20 sec, the 13½ miles thence to Saltash in 14 min. 40 sec., and the last 4½ miles into North Road in 11 min., giving a time of 58 min. for the 35 miles from Par, as against 62 booked. Therefore 6¼ min. were gained by engine from Truro, and, to those who are acquainted with the tremendous difficulties of the route, these figures will show very meritorious work.

My Preston friend has furnished some records with South Wales expresses, two with the afternoon up boat express from Fishguard, as from Cardiff to London, being exceptionally fine. On the first, with the 4-cylinder 4–6–0 No. 4023, *King George*, and a load of 250 tons, fair work was performed throughout. The 11¾ miles from Cardiff to Newport, start-to-stop, took 15½ min. Restarting from Newport, Severn Tunnel Junction, 9¾ miles, was passed in 12 min. 52 sec., and the tunnel itself threaded in 5 min. 27 sec.

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The 10¾ miles through from Severn Tunnel Junction to Patchway took 16 min. 29 sec. —not a very brilliant effort this, certainly—but on the subsequent 13 miles over the new line to Badminton only 16 min. 21 sec. were spent. Thus 45 min. 42 sec. in all had been consumed on the initial 33½ miles. Brisker running followed, the 17 miles on to Wootton Bassett being covered in 15 min. 19 sec., but the slack through the latter junction caused the 5¾ miles thence to Swindon to take 6 min. 12 sec. Then matters improved, and the 24¼ miles from Swindon to Didcot were covered in great style in 20 min. 38 sec., following which a 12 min. 18 sec. time was secured for the 14¼ miles from Didcot to Tilehurst. Thus Reading, with a slow stop, was reached in 104 min. 6 sec. from Newport (97½ miles), the booking being one of 109 min. Smart running was also made from Reading, Slough, 17½ miles, being passed in 18 min. 21 sec. from the start; Southall, 27 miles, in 27 mins. 6 sec.; and Acton, 31¾ miles, in 31 min. 25 sec. Paddington was reached in 37 min. 44 sec. start-to-stop. Thus the engine economised in succession 2½ min., 4 min. 54 sec., and 2 min. 16 sec. on booked times—total 9 min. 40 sec.

The second run, however, eclipsed these figures, the engine in this case being a 2-cylinder 4–6–0, No. 177, *Robertson*, with a load of 215 tons. Very smart running was made from the start, only 14 min. 29 sec. being consumed between Cardiff and Newport, on an 18-minute booking. Similarly in starting from Newport only 11 min. 50 sec. was taken for the 9¾ miles to Severn Tunnel Junction; 28 min. 11 sec. for the 20½ miles to Patchway; and 43 min. 18 sec. for the 33½ miles up to Badminton, the Severn Tunnel itself being threaded in 6 min. 5 sec., or at a more moderate speed than before. With some very fast running, the 17 miles from Badminton to Wootton Bassett were covered in 14 min. 18 sec., and an excellent recovery from the slack resulted in only 5 min. 58 sec. being taken for the 5¾ miles on to Swindon. The running on to Reading was a trifle hindered by a permanent way check at Didcot, but the 24¼ miles from Swindon to Didcot were covered in 21 min. 31 sec., and the 17 miles thence to Reading stop occupied only 15 min. 18 sec.

On this remarkable run, therefore, an economy of more than 8½ min. on schedule had been effected from Newport to Reading by covering 97½ miles in 100 min. 23 sec., or 98 min. net. A further tremendous spurt was made from Reading, Slough, 17½ miles, being passed in 17 min. 10 sec.; Southall, 27 miles, in 25 min. 13 sec.; and Acton, 31¾ miles, in 29 min. 18 sec. By this means the exceptional start-to-stop time of 35 min. 31 sec. was registered for the 36 miles from Reading to Paddington—a further gain of 4½ min. The total gain on schedule time therefore amounted to the extraordinary figure of 16 min. 37 sec., or quite 19 min. net. Arrears of nearly 14 min. at Cardiff was converted to an arrival 4 min. early at Paddington; while the actual running time, excluding duration of stops only, amounted

Photo] [*A. T. Worlock.*

LONDON AND NORTH WESTERN RAILWAY: UP LIVERPOOL EXPRESS, NEAR WATFORD.
Locomotive No. 469 *Marmion.*

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to only 135 min. 54 sec. for the 133½ miles from Newport to London. Such is the truly phenomenal reserve power possessed by these engines, which seems to render them capable of any feat, even on such a first-class express as this.

Descriptions of work on the South Wales line west of Cardiff rarely appear in these columns. On that account the further log my Preston friend sent of the 8.45 a.m. down Fishguard boat express, as between Cardiff and Landore, is of special moment. The engine was one of the new 2-cylinder 4–6–0 "Court" class, No. 2937, *Clevedon Court*, having a heavy load for this route of six 70-ft. coaches, including restaurant car, and three other eight-wheelers—total with passengers 295 tons. Starting as usual very briskly, the 4 miles from Cardiff out to St. Fagans occupied only 6 min. 22 sec.; the next 7¼ miles to Llantrissant, up grades steepening to 1 in 161 and 187 at that station, 8 min., and the last 2¼ miles to Llanharan summit, mostly at 1 in 106, 3 min. 10 sec. The minimum speed on the 1 in 106 was 42·8 miles per hour, and Llanharan, 13½ miles from Cardiff—entirely uphill—was passed in 17 min. 32 sec. Down the 1 in 138 and 157 past Pencoed a maximum of 75 miles per hour was touched; but approaching Bridgend a very severe relaying slack was encountered, so that the 6¾ miles from Pencoed to Bridgend occupied 7 min. 3 sec., and the 5 miles thence to Pyle, mostly up an adverse grade of 1 in 132 to 163, 7 min. 19 sec. On the Pyle bank—4 miles beginning at 1 in 193 and easing to 1 in 139—the high maximum speed of 85·7 miles per hour was touched, and the 7¼ miles from Pyle to Port Talbot were covered in 5 min. 28 sec., the speed continuing well over the undulating stretch of 5½ miles on to Neath, which were covered in 5 min. 17 sec. On the 2 miles of 1 in 99 and 88 up to Skewen the speed fell to 26·5 miles per hour, causing 2¼ miles to take 4 min. 28 sec. A second severe permanent way check spoiled the recovery on the ensuing down grade, so that the last 4¼ miles from Skewen to Landore took 7 min. 50 sec. Yet with both delays, and a heavy load for these grades, the engine had completed the 44½-mile journey in 55 min. 12 sec.—only 12 sec. over booked time. At the most modest estimate the delays could not have cost less than 4¼ min., leaving a net time of only 51 min. for the journey. The trip itself seems strongly reminiscent of runs on the London and South Western line between Salisbury and Exeter.

Photo] [*A. T. Worlock.*

GREAT NORTHERN RAILWAY: 5.30 P.M. DOWN EXPRESS NEAR HATFIELD.
Locomotive No. 1459 (Schmidt Superheater).

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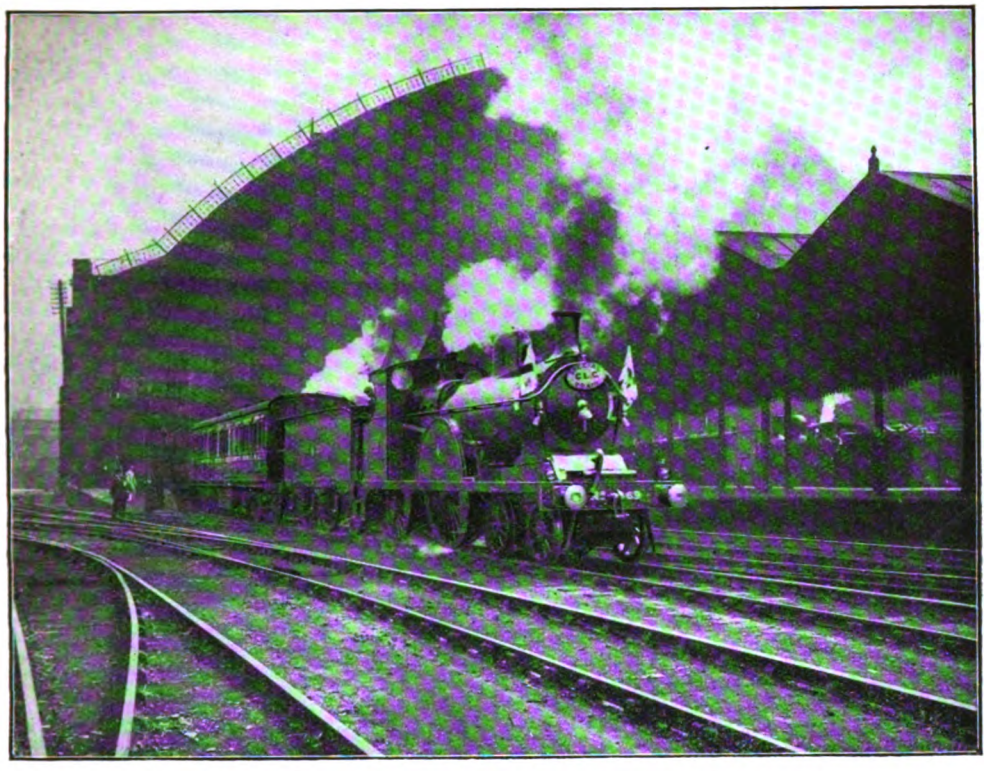

ISLE OF MAN BOAT EXPRESS LEAVING MANCHESTER CENTRAL STATION.

The Cheshire Lines Committee:

BRITAIN'S PREMIER JOINT RAILWAY.

ALTHOUGH a joint undertaking, the Cheshire Lines system is managed in the same way as an independent railway, in that it has a board of directors and a full staff of officers. The Great Northern, Great Central and Midland Railway companies subscribe the necessary capital, and each of the parent companies nominate three of their directors to represent the respective concerns on the Board of the Cheshire Lines. These nine directors form the "Committee," and meet monthly.

Students of railway history will find the genesis of the undertaking embodied in parliamentary powers which were conferred in 1860. Under these and subsequent Acts various portions of the railway were constructed. On July 1st, 1866, the Midland Company became third partner in the undertaking, which has developed into the important railway illustrated by the map on page 386. The Cheshire Lines, claiming precedence as Britain's premier joint railway, enjoys an enviable reputation in respect of punctuality and enterprise.

Owned by the Committee is a total mileage of 128 miles 15 chains. In addition, the Committee work by agreement the Southport and Cheshire Lines Extension Railway, 14 miles in length, which forms a continuation of the Committee's system from Aintree to Southport. There are 70 stations on the combined systems of the Cheshire Lines and the Southport Extension, the most important places served being Liverpool, Manchester, Birkenhead, Stockport, Warrington, Northwich, Winsford, Knutsford, Chester and Southport. This list sufficiently demonstrates that, however appropriate may have been the title of "Cheshire Lines" half a century ago, it is somewhat a misnomer to-day, when the major portions of the lines are laid in Lancashire and the principal places

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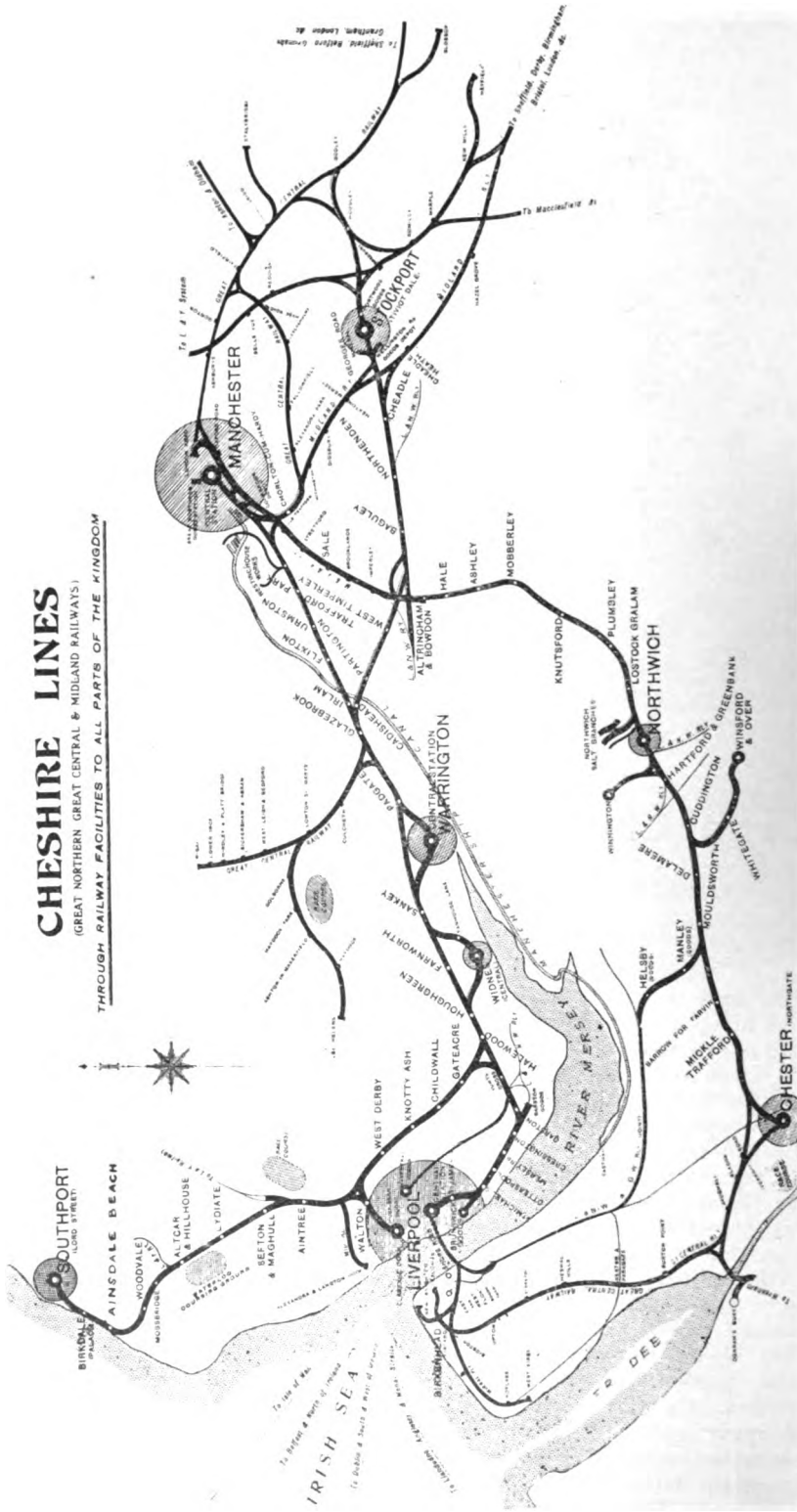

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served are likewise in the County Palatine.

Among railway engineers the Cheshire Lines has a good name because of the excellence of its permanent way. Possessing directors but no shareholders, the railway differs from independent systems in that it owns rolling stock, but has no locomotives of its own. The parent companies supply engines for working the traffic, and the Great Central haul most of the joint trains.

tons. Space does not here permit a complete record of all the ramifications of the Committee's system, but it is desirable that particular reference should be made to Liverpool and Manchester, as the two principal sources of traffic.

Liverpool claims to be the greatest seaport in the United Kingdom, and it needs only a sail up the Mersey, or a ride on the Overhead Electric Railway to confirm all that has been written or said of the commercial greatness of that city.

ISLE OF MAN PASSENGERS LEAVING THE CENTRAL STATION, LIVERPOOL, FOR THE LANDING STAGE, *en route* TO DOUGLAS.

The Committee's passenger stock is painted oak brown, and the largest coaches are 54 ft. 8 in. in length. All the carriages are lighted by electricity or oil gas, and fitted with the automatic vacuum brake. The Committee own 447 coaching vehicles and 4,074 goods wagons. To indicate briefly the extent of the Committee's business, it may be mentioned that during the year ending December 31st, 1911, the passengers carried, excluding season ticket holders, numbered 10,385,052, and the general merchandise and minerals dealt with during the same period amounted to 7,882,285

The miles of magnificent docks, the large blocks of warehouses and countless branches of railway lines illustrate in a striking manner the maritime importance of this Western Gate of the Empire. Ships are always to be seen arriving, discharging, loading or departing; and the prodigious quantities of grain, cotton and other produce continually arriving in the port make Liverpool a gigantic distributing centre, especially for Cheshire and Lancashire and Yorkshire towns. About 30 per cent. of the total commerce transit of the Empire, as well as the greatest bulk of United States,

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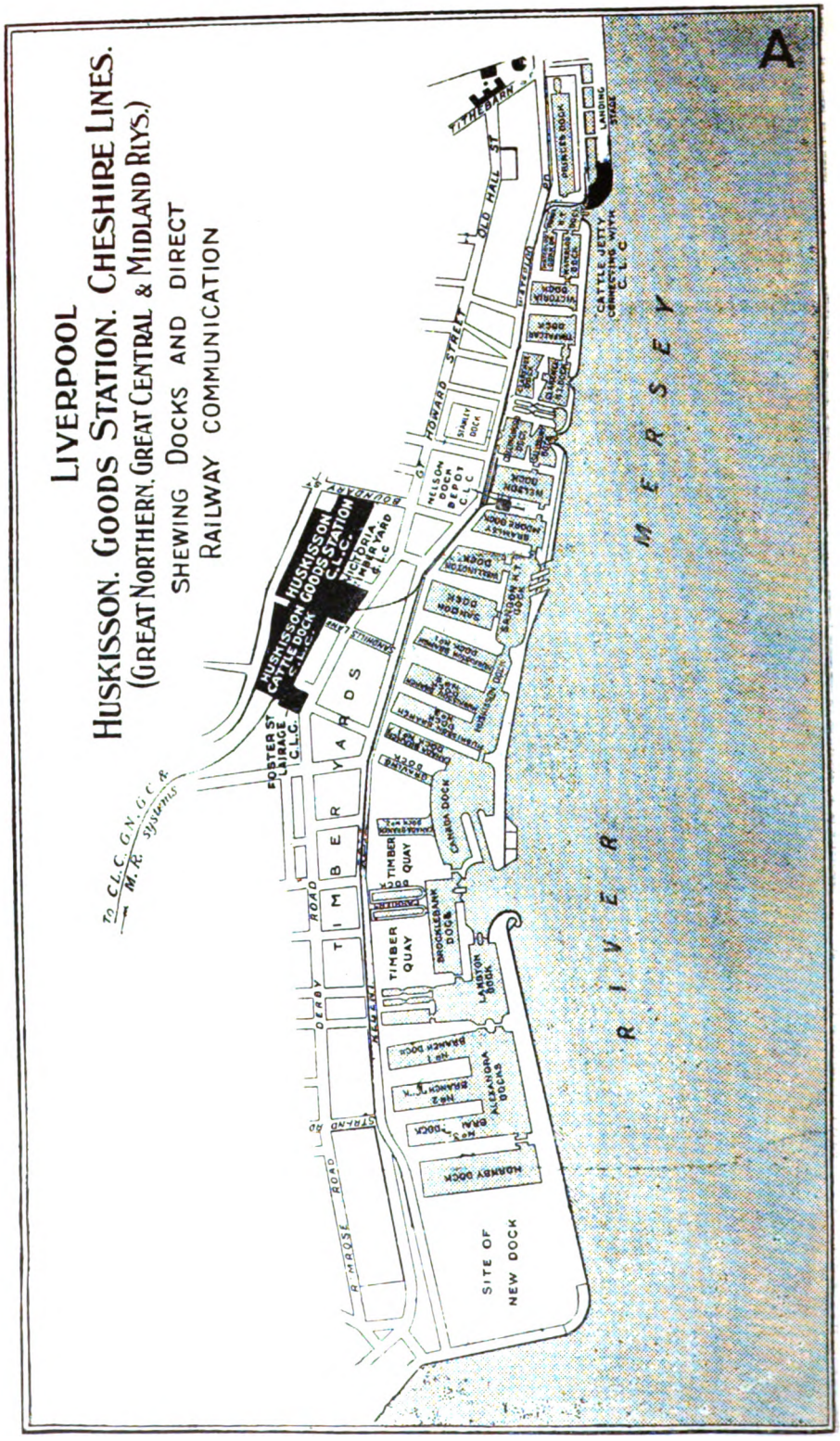

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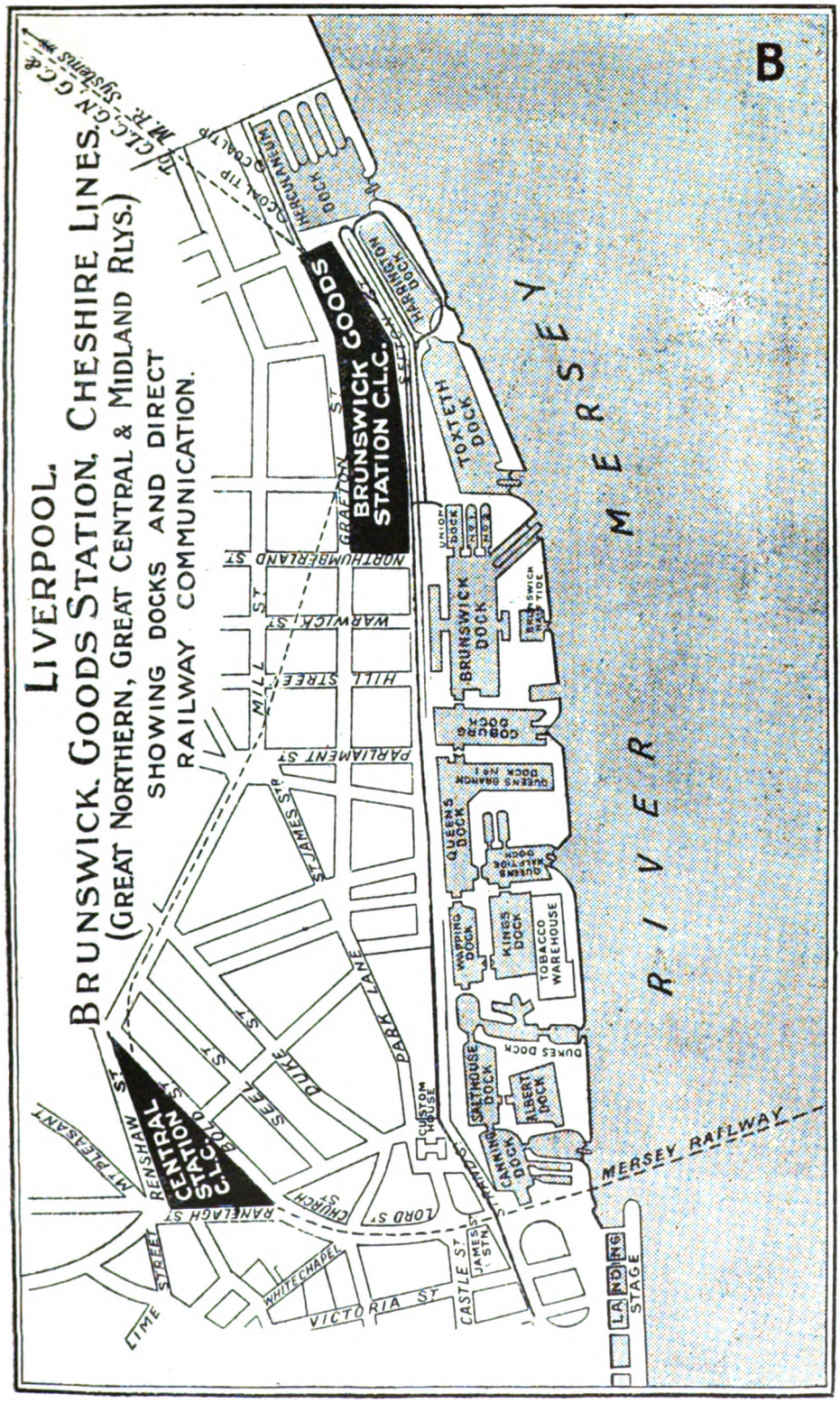
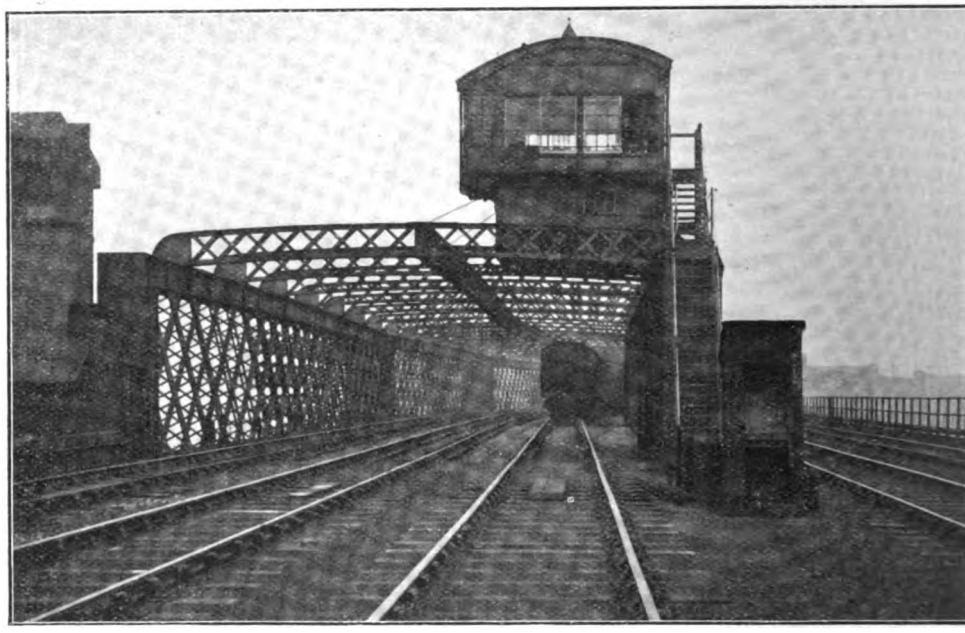

B
LIVERPOOL.
BRUNSWICK GOODS STATION, CHESHIRE LINES.
(GREAT NORTHERN, GREAT CENTRAL & MIDLAND RLYS.)
SHOWING DOCKS AND DIRECT
RAILWAY COMMUNICATION.
BRUNSWICK GOODS STATION C.L.C.
CENTRAL STATION C.L.C.
RIVER MERSEY
HERCULANEUM DOCK
HARRINGTON DOCK
TOXTETH DOCK
BRUNSWICK DOCK
COBURG DOCK
QUEENS DOCK
WAPPING DOCK
KINGS DOCK
TOBACCO WAREHOUSE
SALTHOUSE DOCK
ALBERT DOCK
CANNING DOCK
DUKES DOCK
CUSTOM HOUSE
MERSEY RAILWAY
LANDING STAGE
NORTHUMBERLAND ST
WARWICK ST
HILL STREET
PARLIAMENT ST
MILL ST
GRAFTON ST
ST JAMES STR
PARK LANE
DUKE ST
SEEL ST
BOLD ST
RENSHAW ST
MT PLEASANT
RANELAGH ST
CHURCH ST
LORD ST
WHITECHAPEL
VICTORIA ST
CASTLE ST
JAMES STN
LIME STREET
COAL TIP
C.L.C., G.N., G.C. & M.R. Systems

Canadian, West African and South American passenger traffic, is exported and imported through Liverpool, and it is not difficult to picture the great railway resources requisite to carry on successfully this enormous transport business.

The Cheshire Lines Committee has contributed largely to facilitate the trade of the port by the provision of goods depots at various points contiguous to the docks. Principal among these depots is Huskisson Dock station, situate at the north end of the city, and connected by rail direct, as shown on the diagram shown on page 388, with the Alexandra, Bramley Moore, Brocklebank, Canada, Clarence, Collingwood, Huskisson, Hornby, Langton, Nelson, Princes, Salisbury, Sandon, Stanley, Trafalgar, Victoria, Waterloo and Wellington Docks.

Huskisson station is well equipped for dealing expeditiously with all kinds of general merchandise, minerals, and live stock, and is conveniently located for the delivery and collection of traffic to and from warehouses and places of business in the Northern district of the city, as well as in the Bootle, Walton and Everton neighbourhoods. The most approved appliances for dealing with all kinds of import and export traffic have been provided. Extensive cellars for storage are available, adjacent to the timber yards of the Mersey Docks and Harbour Board, and there is ample open space for the storage of timber. Large sections of buildings have also been set apart for dealing exclusively with cotton, wool, grain, oilcake, sugar and merchandise of a similar character.

The accommodation for live stock at Huskisson station is unsurpassed in the United Kingdom. It includes a number of pens sufficient to permit of 2,000 head of cattle being dealt with at one time. A very large traffic in Irish cattle passes through the station week by week, and a special feature is made of the handling of prize cattle and valuable animals for export. At Foster Street, adjacent to Huskisson, the Cheshire Lines have established lairage capable of accommodating a further 1,200 cattle, which may require rest after a rough sea passage, or may have to remain in Liverpool several days before being despatched by rail to destination. At the south end of Liverpool, the Cheshire Lines have erected a large depot adjoining Brunswick Dock, which, as shown on page 389, is connected by rail with the Albert, Canning, Coburg, Harrington, Herculaneum, Kings, Queens, Salthouse,



VIADUCT SIGNAL CABIN, SHOWING "B" ROUTE INTO THE CENTRAL STATION, MANCHESTER.

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Photo] [*Lafayette.*

MR. JOHN E. CHARNLEY,
Manager, Cheshire Lines Committee.

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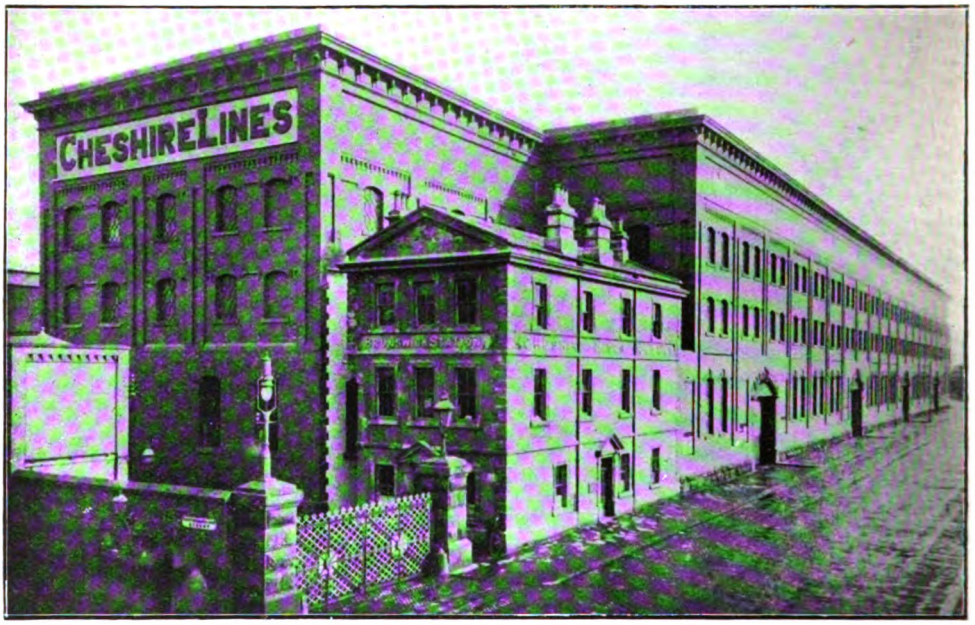
Toxteth, Union and Wapping Docks. There large quantities of fruit, vegetables, fish and other perishable traffic are handled. Of the most up to date character and fire-proof throughout, the warehouses are well equipped with mechanical and electrical appliances for dealing expeditiously with all kinds of traffic.

From Brunswick yard direct rail access is given to Herculaneum Coal tips, where powerful cranes are provided for tipping wagon loads of coal direct into the ships. There is likewise excellent accommodation for storing a large number of wagons, preparatory to being placed under cranes for loading into ship. In the south east portion of Liverpool the Cheshire Lines Wavertree and Edge Hill station serves the populous districts of Wavertree, Edge Hill, Stoneycroft, Stanley, and Fairfield, and excellent facilities are there provided for dealing with traffic.

Up till 1874 the Cheshire Lines dealt with their own, as well as with the passenger traffic of the Great Northern, Great Central (or as it was then called Manchester, Sheffield and Lincolnshire) and Midland Railways at Brunswick station, whence passengers were conveyed in omnibuses to the head offices of the Committee, then located in Alexandra Buildings, James Street. Growing traffic, coupled with the inconvenience and delay in transferring passengers and luggage between Brunswick and the city, induced the Committee in that year to obtain powers for the construction of an extension from Brunswick to Liverpool Central, a distance of 1¾ miles. Although only short, this work was beset by many difficulties, the line having to be cut through rock the whole length of Great George Street to its exit at the top of Bold Street, alongside which it runs to the centre of the city in Ranelagh Street. But the contract was completed in five years, enabling the station to be opened to the public on March 2nd, 1874.



BRUNSWICK GOODS STATION.

The Cheshire Lines headquarters are at the Central Station, Liverpool, where a total area of about 5½ acres is covered by the station offices. It is generally acknowledged that the station is remarkably well laid out, but the approach by rail is of the "bottle neck" character. The station has, however, always been staffed by men who evidently ask "What are difficulties for, if not to be overcome?" In spite of the apparent insufficiency for the passage to and fro of about 170 trains per day and for the movements of light engines and empties, the work is invariably accomplished with a smartness that speaks well for the capability

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Photo] [*Medrington, Liverpool.*

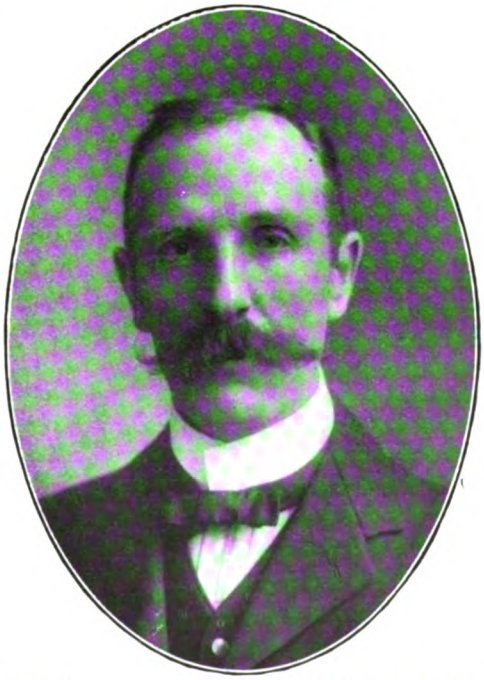
MR. GLEGGE THOMAS, F.S.I.
Secretary and Estate Agent.

Photo] [*Noreen Kirby, Liverpool.*

MR. H. BLUNDELL, M.I.C.E.
Engineer.

Photo] [*Medrington, Liverpool.*

MR. W. H. OATES.
Assistant Manager.



Photo] [*Medrington, Liverpool.*

MR. JOHN YOUNG.
Accountant.

CHIEF OFFICERS OF THE CHESHIRE LINES.

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of the responsible officers and the discipline and workmanship of the staff. On a busy Bank Holiday, when the task is supplemented by 40 or more specials, the management of the station calls for no small skill in railroading. Below the cab road and platforms 1 and 2 is the terminus of the Mersey Railway. The station is connected by lifts and subways with this electric line and its service to Birkenhead, Rock Ferry, New Brighton, Hoylake, West Kirby and the Wirral Peninsula generally.

From the Liverpool Central station an excellent service of trains is provided at cheap rates for the suburban traffic to St. Michaels, Aigburth, Otterspool, Cressington, Garston, Hunts Cross, Gateacre and other stations, which are acknowledged to be the most attractive residental districts in the suburbs of Liverpool. A frequent, rapid and comfortable service of trains is also run by the Great Northern, Great Central and Midland Companies to London, Sheffield, Hull, Derby, Nottingham, Leicester, Buxton, Matlock and the Eastern Counties. The Liverpool steamboat services are well served by the Cheshire Lines. On arrival at the Central station, passengers are conveyed free of charge by special wagonettes to the landing stage.

During the summer months the popular morning and afternoon service to the Isle of Man and the daily service to the North Wales Coast bring hundreds of holiday makers to Liverpool Central. The boat services from Liverpool to Dublin and Belfast throughout the year are largely fed by passengers arriving from inland towns *viâ* the Cheshire Lines system. Probably the most popular side of railway enterprise in the City of Liverpool is that connected with the Atlantic passenger trade, and it may be specially mentioned that during the last two or three weeks of 1912, no fewer than 6,000 Bulgarians, Servians and Greeks, returning from Canada and the United States, were received at the Central station, and despatched by special trains to Grimsby *en route* to their respective countries in response to calls to their countries' aid.

VICTORIA YARD, HUSKISSON GOODS STATION.
(Timber and full loads).

Few cities have a wider commercial reputation than Manchester, and its present great prominence is due to its many manufactures and general business. Although long styled "Cottonopolis," many other industrial arts flourish, and Manchester pursues its great career of development. The opening of the Ship Canal from the Irwell to the sea, in 1894, enabled ocean-going

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A SECTION OF THE HUSKISSON GOODS STATION.

"C" SECTION, HUSKISSON GOODS STATION (HEAVY MACHINERY, ETC.)
Steam and Electric Crane capacity up to 36 tons.

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THE CENTRAL STATION FRONT, MANCHESTER, AT 9.55 A.M.

steamers to sail into the heart of the city. Large docks have been built in Manchester and Salford to accommodate the shipping, so that Manchester is not only a great manufacturing centre, but a vast emporium and distributing depot. The construction of the Canal afforded a vivid illustration of the city's ambition. As Manchester could not go to the sea, the sea was brought to Manchester. Over £15,000,000 was expended upon the scheme; but the money was well spent, and imports and exports *viâ* the canal are increasing in volume and value year by year.

The Cheshire Lines was the first railway to give rail connection with the Ship Canal docks by a branch line from the main line at Cornbrook, and later at Trafford Park, where extensive sidings have been laid down for the purpose of exchanging traffic of every description with the Ship Canal Company. A junction with the dock estate is effected by means of two bridges over the Duke of Bridgewater Canal, which is now owned by the Ship Canal Company. One branch encircles the world-famous Westinghouse Works and the other, after crossing Trafford Park Road, serves the whole of the Salford and Pomona Docks, enabling the Cheshire Lines to place trucks alongside any ship for despatch of goods abroad. Imports *ex*-ship are expeditiously loaded into trucks with a minimum of handling, and dispatched by express goods trains to all parts of the country. Transit has been greatly improved since the opening of Throstle Nest curve—a short length of 48 chains connecting the Manchester and Liverpool section of the railway with the Chorlton-Cum-Hardy branch, and giving direct connection at Chorlton Junction with the Great Central and Midland Railway Companies' main lines to Sheffield, Derby, Nottingham, Leicester, London and the East and Western Districts.

Coincident with the opening of their Manchester Central Passenger station on July 1, 1880, the Cheshire Lines inaugurated a service of express trains, 13 each way, between Manchester and Liverpool, starting from the respective Termini in Liverpool and Manchester at half past the hour, 8.30 a.m. to 9.30 p.m., with one stop at Warrington. This service—one of the finest in the country—has been maintained with undeviating punctuality. The trains are formed of the latest and most comfortable rolling stock, and are deservedly popular.

Manchester Central station, covering over

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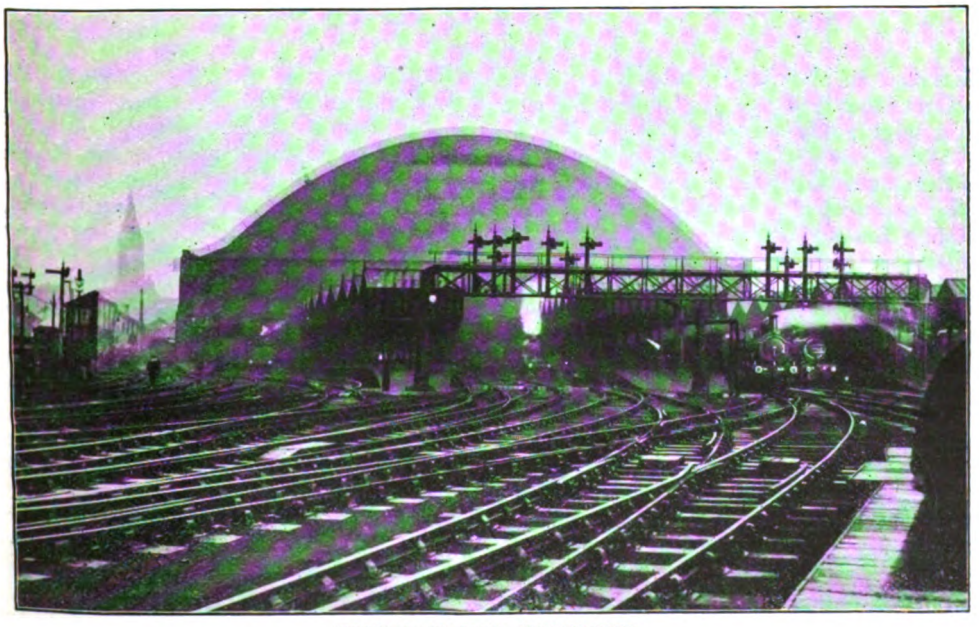
10 acres, is the largest station on the Committee's system. It accommodates not only the Cheshire Lines trains, but those of the Great Central, Great Northern and Midland Railways. There are eight platforms, the principal of which is 685 ft. in length, and at these platforms 320 booked passenger trains are received or despatched daily. The largest signal box on the Cheshire Lines system is at Manchester Central station, and contains 208 levers. This important station was illustrated and described in the RAILWAY MAGAZINE, March, 1905.

For goods traffic the Cheshire Lines makes a bold bid wherever and whenever its agents find an opportunity of influencing trade. It has keen competition to face at almost every important point on the system, but the management goes whole-heartedly into the business, and every effort is made to keep the machinery of the Committee quite up to date. In addition to the important depots already mentioned, extensive accommodation is provided at Stockport (Portwood), Northwich, Knutsford, Hale, Chester, Warrington, and Southport, and there is an important goods station in Birkenhead. Hydraulic power, electric cranes, electric light and all modern appliances are at the disposal of the company's agents for furthering the prompt despatch of traffic.

A notable feature of the Cheshire Lines is its important connections. Take the Great Central for instance. By means of Godley Junction a through service is maintained from Liverpool, Southport and the Cheshire Lines generally to Sheffield, Nottingham, Hull, Grimsby Docks, Retford, and London. Outside Chorlton-cum-Hardy station a junction is formed enabling the Great Central, by means of its railway from Fairfield, to run trains into the Central station, Manchester. In addition to these connections, the system of the Cheshire Lines is linked with the Midland Company's main line at Cheadle Heath, and by this route trains are run to and from London (St. Pancras) and the Midland districts.

Midland express trains between Manchester and the south traverse the Cheshire Lines metals between Manchester (Central) and Chorlton-cum-Hardy Junction—a distance of about three miles—and again, between Heaton Mersey Junction and Bredbury Junction, about three and a half miles. The same company's trains to and from Liverpool and Southport also use the Cheshire Lines between Bredbury Junction or Cheadle Junction and Liverpool (Central). Express trains of the Great Northern Railway run between London (King's Cross), Manchester and Liverpool Central stations. These trains form connection with the Cheshire Lines at Godley



CENTRAL STATION, MANCHESTER.

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LORD STREET STATION, SOUTHPORT.

Junction. In Manchester, adjacent to the Cheshire Lines terminus, the Great Northern has a large goods station, access to which is obtained over the Cheshire Lines from Chorlton-cum-Hardy Junction.

No account of the enterprise of the Cheshire Lines would be complete without at least a passing reference to "Sunny Southport"—the famous Lancastrian seaside resort. This charming town, incorporated in 1867, has long been a favourite summer holiday haunt, but of late years has advanced in public favour as a winter holiday home, and daily welcomes large numbers of people who carry on business either in Manchester or Liverpool. Southport offers a genial climate coupled with many noble thoroughfares. Its permanent amusements are varied and numerous. Opened in 1884, the Southport and Cheshire Lines Extension from Aintree—14 miles in length—quickly proved an enormous advantage to the town by reason of its direct connection with the Great Northern, Great Central and Midland railways. During the summer months the traffic dealt with at Southport (Lord Street) is exceedingly heavy, and on a Bank Holiday the passengers sometimes number from 40,000 to 50,000.

As will be seen by the map, the south western terminus of the Cheshire Lines is at Northgate station, Chester. In 1875 the line was extended from Mouldsworth to Chester, and opened for passenger traffic on May 1, of that year in time for the Committee to compete for the Chester race traffic by running a service of trains from Stockport and Manchester. The terminus at Northgate is the nearest railway station to the Chester race course—a circumstance in itself sufficient to secure the patronage of much of the motley crowd which follows so faithfully the fixtures

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made year by year for the furtherance of "the sport of Kings." There are other classes of visitors to Chester, who find the Cheshire Lines an admirable means of reaching the ancient city. Antiquarians, lovers of the picturesque, and many who go especially to view the magnificent cathedral, all swell the crowd of tourists who annually visit this quaint and attractive old city on the Dee.

Reference has been made to the interest which the Cheshire Lines has in Chester Races, but sporting readers of the RAILWAY MAGAZINE need not the reminder that the "Grand National" takes place each year at Aintree, and that the station belonging to the Committee is close to the race course. The popularity of this famous race continues to grow, and each year, no matter what may be the climatic conditions, attracts a huge attendance. Sefton station, the first north of Aintree on the Southport Extension Line, adjoins the famous meadows, which, when flooded in time of frost, provide healthy enjoyment to thousands of skaters. Altcar and Hillhouse, the third station below Aintree, serves the scene of the annual coursing contests for the "Waterloo Cup."

Mr. J. E. Charnley, Manager, Cheshire Lines Committee, whose portrait appears on page 391, was appointed to that position in 1911, after an extensive and varied experience with the Lancashire and Yorkshire Railway. In 1899 he was made Passenger Superintendent at Wakefield, and in 1903 his headquarters were removed to Halifax. In 1905 he was selected as one of the delegates to represent the Lancashire and Yorkshire Railway at the International Railway Congress in Washington, U.S.A. Known and respected as a strict disciplinarian, Mr. Charnley is ever mindful of the best interests of the railway workers, and always ready to promote their welfare in every possible way.

Photo] [*F. E. Mackay.*

SUMMER EXPRESS FROM LIVERPOOL (CENTRAL) TO CROMER.
Rebuilt Pollitt engine, No. 877.

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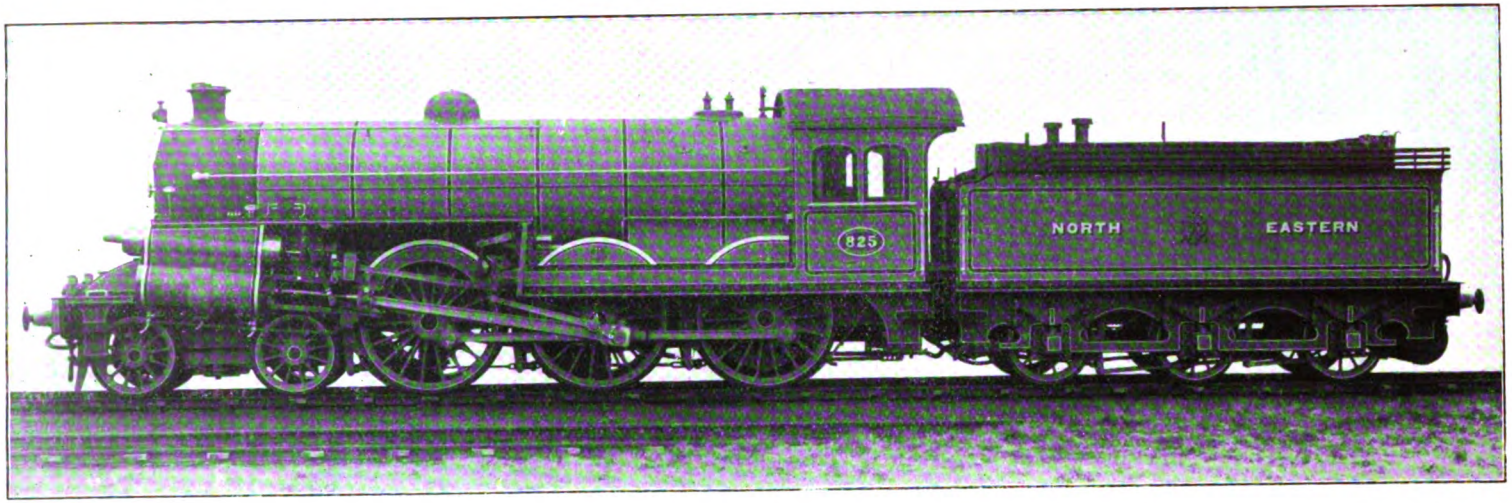
New Superheater 4-6-0 Locomotive with Stumpf "Uni-Flow" Cylinders: North Eastern Railway.

Designed by Mr. V. L. Raven, Chief Mechanical Engineer.



This engine is generally of the S2 superheater class introduced last year, with 20 in. by 26 in. cylinders and 6 ft. coupled wheels, but is peculiar in that it is fitted with Stumpf "uni-flow" cylinders. The object of the Stumpf system, tested somewhat exhaustively on the Continent, is to obviate the alternate heating and cooling which results when the same ports are used both for admission and for exhaust, at the same time realising certain other advantages claimed for the "uni-directional" flow of steam. This experiment, the first in British practice, is therefore of exceptional value, especially in view of the fact that locomotives almost exactly corresponding therewith in other respects will also be available for comparative trial.

The cylinders are about double the length of the stroke, owing to the fact that the piston itself—of hollow design—is as long as the stroke. The exhaust ports are placed midway, as indicated by the projection or rib visible in the illustration. These ports are not controlled by valves, the piston itself covering or uncovering them at the ends of the respective strokes. The piston valves are also of special design, and notable for their large dimensions, though in the Stumpf system they serve only for controlling steam admission.

Walschaert valve gear is used, this engine being, we believe, the first on the North Eastern Railway to be so fitted, either inside or outside. It is adopted, in this case, as being more convenient than the link motion for the constructional conditions created by the use of Stumpf cylinders. The front end of the engine is specially built in certain respects, but, as far as possible, other parts correspond with the standard practice of the class.

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Leaves from the Log of a Locomotive Engineer. [No. VIII.]

By ROBERT WEATHERBURN.

ONE of the least attractive places in winter to be found in Russia is Werchovia, in the Government of Orel. It is a junction on the Orel and Kursk 5 ft. gauge trunk line with the Livny narrow gauge railway. The latter runs up a somewhat hilly country to Livny and Ruski Brod. The origin of this line is of interest. Count Bobrinsky, once Minister of Russian Railways and a great favourite with the Emperor Alexander, had been on a visit to the late Duke of Devonshire's father at Chatsworth. Much concerned in railways at the time, and particularly in the Fairlie system of narrow gauge, worked by the double bogie engines, then being exploited for all they were worth, the Duke accompanied the Count to the Festiniog Railway to see the minature line worked by the "Little Wonder" (Fairlie's Engine).

So impressed was the Count by the apparent cheapness and efficiency of the Welsh undertaking, that he became one of the most enthusiastic advocates of the system, and himself wrote a pamphlet which, published in Russian, French, and English, was distributed broadcast among the Ministers, nobility and merchants of the country.

The Emperor readily gave his consent for a trial line to be constructed between Werchovia and Ruski Brod, called the Livny Railway, stipulating that it should be surveyed and laid out by the staff and students of the St. Petersburg Polytechnic School, under the leadership of Professor Schubertsky and Count Von der Desen. For this railway the contract was let and sub-let to Jews. The double bogie engines were made to Fairlie's design, and built by Messrs. Sharp, Stewart & Co. In order to demonstrate their superiority in traction and curving over the ordinary design, several small four-wheeled coupled tender engines with Bissel bogies were made by the Leeds firm of Kitson & Co. At that time Werchovia consisted of seven small wooden houses, specially constructed for the engineering staff and a wood shed for the locomotives, but minus the fittings, as the winter had put an end to the further progress of the work. The enterprising, but unscrupulous Jewish contractors who had the permanent way to construct had laid some portions of the road on the snow—a system of ballasting that might do in winter, but which at the breaking up of the frost left the rails and sleepers suspended over many of the hollow places, necessitating frequent stoppages to make good, after the opening.

PROFESSOR SCHUBERTSKY.

Some weeks previous to our arrival, the engines had been forwarded on special

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trucks and in the course of transit over the North German lines and through Poland the boilers, frames and cylinders had become thickly incrusted with snow and ice. The clearing of this with chipping hammers and scrapers in the open (as neither engines nor trucks could be got into the sheds) during the severe weather preparatory to erection, was a bitter experience. Every chisel, bar or file had to be handled with thickly gloved hands, or the penalty was loss of skin. The worst of those trying days was when the sharp cutting winds blew. These in several instances peeled the skin from the nose and cheeks, leaving them raw as though they had been scorched by a blast of fire. The ears could be kept covered by the capotes, but the nose and other exposed parts of the face, suffered to some extent with every one.

Under the difficulties labour was magnified a hundred fold, and our relief was considerable when the temporary rails were laid over the snow into the unfinished shed. Some little idea may be formed of the inconveniences suffered when I relate that washing was unknown, water not being obtainable for either culinary or lavatory purposes. Our "samovar," or tea urn, as needful an institution with us as to the born Russ, had to be supplied with snow. Our beds, largely composed of rye and oaten straw, laid on the bare floor, afforded us only the most meagre rest. The rooms were heated to a hot-house temperature by means of the native stove. During the long dark evenings and nights the only light was afforded by evil smelling paraffin lamps, dirty and dangerous to handle. Frequently in the mornings, when turning out, we could trace the spoor of wolves which had prowled around our isolated and detached house. Fortunately the running shed was only sixty or seventy yards away.

M. LAMORIER.

One day, wishing to get a drink of hot tea, I opened the small wicket door of the shed, and as quickly as possible closed it after me to keep the cold out. I began to run across the intervening space with head down to avoid the sharp piercing blast blowing directly towards me, when, chancing to lift my head a little, I saw, not a dozen yards in advance, a large gaunt wolf standing, forced no doubt by hunger to forage in our neighbourhood. Knowing well that there was not a soul outside, that there was no possibility of assistance should I call ever so loudly—my Colt's revolver was in the hut and that I was therefore helpless—I experienced a sensation which I trust may never again occur. Fortunately I did not lose my presence of mind. I felt sure that to turn and run would prove disastrous. So I stood looking at the beast for fully ten or fifteen seconds, during which time I could distinctly hear my heart beat, when, to my intense relief, the wolf with half averted look, as though reluctant to leave, ambled slowly away. Then I started a slow backward movement towards the shed, not daring to run until I got within a few yards, when I dashed at the door, which opened inwardly. Rushing to the fire, I seized a bar of iron, and in company of my other colleagues similarly armed sallied out, but the animal was not then to be seen. It is only in very hard weather similar to which we were then having, and when pressed with hunger, that solitary wolves will attack men. But it is not uncommon for them singly to attack women or children in lonely places, and their ferocity is so great that unless speedily

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despatched or beaten off, the injuries they inflict are mortal.

The question of water for the locomotives during winter had had the attention of the authorities, and the shed was constructed with a loft above containing a large wooden tank. For several days and nights before the completion of the two first locomotives, a couple of moujiks had been employed in keeping fires of birchwood lighted in this upper story, and at length we had the satisfaction of being able to fill the boilers of the locomotives which were completed. After satisfying ourselves that the injectors would work, we moved the engines backward and forward with great care, to thoroughly warm them through; but for a time the main difficulty was with the oil, which had to be heated before it would run, and then as speedily congealed. Although every motion bolt and pin had been oiled before insertion, they had frozen stiff. Often have I seen the oil, a mixture of paraffin and rape, when heated to fluidity issue from the oil spout a bluish tint. But when dropped or poured on the cold frosted surfaces, it would take the consistency and hardness of tallow, so that during the more intense cold in these regions lubrication was only accomplished by the amount of friction, and thawing the lubricant into semi-circulation.

No wonder that a severe winter is followed by a harvest of incapacitated engines and a glut of repairs. Although the feed pipes were provided with wrappings of felt closely bound with spun-yarn, the utmost difficulty was experienced in keeping them from freezing. About this time our progress was stopped by one of those blinding blizzards, composed of snow and drifting particles of frozen moisture, which piled up in hillcocks, and whirled and twisted the snow around every obstacle, banking up the sides of the houses, forcing its way through crevice and crack under the doors of our otherwise solidly built house. In some places the smaller valleys were almost made level, and all communications being stopped, complete isolation followed. Unfortunately, our stock of provisions was getting very low. At no time had it been over abundant, consisting mainly of potatoes and rice, supplemented, when the weather was fine, by a few loaves of black rye bread—a precarious and an uncertain supply from some distant hamlet—with a few quarts of milk. Unmistakable want and famine therefore stared us in the face.

It was at this time that there occurred a most painful incident which might have had fatal results. By prodigious efforts the snow had been cleared for a couple of versts, and the Professor and Count Von der Desen, who were compelled to share our isolation, if not our hardships, gave instructions for one of the tender engines to be got out, and coupled to a new carriage built by the Compagnie de Belge for a trial of the central couplings and a short run round one of the numerous sharp curves as far as the snow would permit. These carriages by the way were very well designed, and tastefully upholstered. Indeed, everything in the way of rolling stock was of the best material and workmanship. The representative of the Belgian firm, M. Lamorier, a most amiable but fussy little man, accompanied us on the trip, if "trip" it might be called. We had not proceeded more than a verst and a half before we encountered a snow drift, which covered the rails for about 200 ft. in length, and had been consolidated by the contractors' sledges passing over it in carrying material to and from the shed.

To cross over this covering I knew was impossible, as the total weight of the engine was not more than 25 tons, which distributed on six wheels, was not sufficient to effectually crush through and displace the hardened mass. But both the Professor and the Count insisted that a trial should be made. Much against my own will, I essayed the attempt. But when nearly half way across, the engine came to a stand. The wheels slipping violently, segmented themselves as they cut down to the rail level, and at every application of steam idly revolved. With some difficulty, owing to the small diameter of the driving wheels under hung springs and breakrods, we managed to punch away a portion of the obstructing hardened snow by means of pinch and jack bars. After a warning touch of the

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whistle I again applied steam. A momentary slip was followed by an agonising scream, and on looking over the off side, I saw the little Belgian on his back in the snow, holding his thigh and uttering cries of pain. Poor fellow! He had sustained a horrid compound fracture of the leg below the knee, the broken bone projecting clean through the skin. It appeared that, without thought of the consequences, and with an idea that he could assist the engine out of the rut, he had inserted a pinch bar between the spokes of the driving wheel, and on my applying steam the engine gave a slip, with the result that the bar, flail-like, struck him between the knee and the ankle. The force must have been great, as the bar was bent and a spring hanger broken.

The weather was terribly cold, and the sharp cutting wind acted like a rasp on the skin of the face. We lifted Lamorier carefully, and placed him in the end *coupè* of the carriage, covered him up with rugs and cushions, and after extricating the engine, hurried back to our miserable quarters. There was no medical aid nearer than Orel, from which we were completely isolated, as the train service on the trunk line had been stopped by the snow. We roughly improvised a plank bed, and made a rough trough for the broken limb, which we straightened to the best of our ability. With no medicines or surgical instruments, food of the coarsest, moistened with water made from snow, the outlook was black indeed. Next morning we applied snow to the limb to reduce the inflammation. The room was fortunately hot enough to keep the patient warm, and having done all in our power we anxiously waited the re-opening of the line. After nearly forty hours of trying impatience and terrible pain on his part, a train was at last signalled and stopped. We carefully hoisted the poor sufferer into a carriage, and placed him in the care of the conductor and one of our men, to be conveyed to Orel. Whenever possible we sent a messenger to ascertain his condition, and to purchase some little dainty which we thought might show our regard.

At last we heard no more, and concluded by the tenor of the news received that he had died. However the sequel was not yet, and it proved what men have often found, namely, that the world is little and that opportunities are great. Nearly two years later, when walking along the Boulevard Richelieu, in the town of Odessa, on our way from the old Government Arsenal, a little dapper figure, with face wreathed in smiles, stepped before us, and shook us in turn warmly by the hand. It was our unfortunate friend M. Lamorier. In a moment my eyes turned to the leg which had been so badly injured, but with many gesticulations and a somewhat pompous strut, he demonstrated that it was now all right. We insisted on his accompanying us to our hotel, and by the aid of a couple of bottles of Krasni Vino we spent a pleasant two hours, and heard his account, which was briefly thus:

On his arrival at Orel, the doctors could not for some time decide what to do, and contented themselves with setting his leg to the best of their ability. His excellent constitution and pluck accomplished the remainder, and when sufficiently convalescent he went home to Belgium. With many grimaces, accompanied by pantomimic action, he showed us how the foot instead of being in proper pose, was set with such an outward "put," that it was impossible to get along without tripping, or being tripped, and, after consultation with a famous surgeon, he agreed to have the leg broken a second time. The operation, barbaric as it appeared, was nevertheless effectual, and our friend whose tongue was loosened by the "Krasni St. George," merrily tripped around to show us the extent of his activity. The only difference seemed to be that the unfortunate limb was shorter than the other, but that I noticed had been thoughtfully dealt with by a somewhat thicker sole to his boot. We saw our Belgian friend away the following day and wished him *Bon Voyage* on his way to Tiflis.

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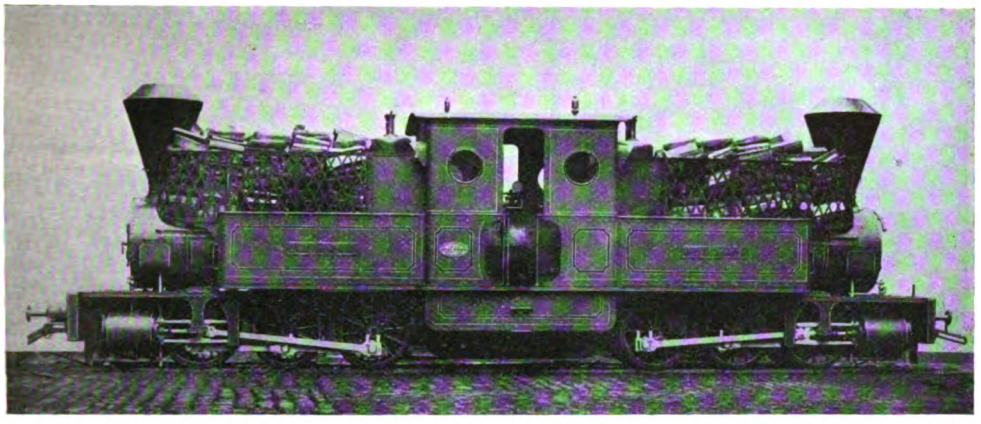

FAIRLIE DOUBLE-BOGIE ENGINE.

The above photograph shows the most improved form of the Fairlie double engine, as built by Messrs. Sharp, Stewart & Co., to the designs of Robt. Fairlie, of the Narrow Gauge Rolling Stock Co. for the Livny Railway, and also for the Poti and Tiflis Railway, in the Caucasus. The name and reputation of so eminent a firm as the builders were not only in themselves sufficient guarantees for excellency of material and quality of work, but further ensured the embodiment of the results of their long and valuable experience in the matter of details and other important adjuncts. It is not too much to say that if this type of locomotive had demonstrated the economy claimed by its inventor, it would with such backing and experience have been a great success. Working weight, about 43 tons; gauge 3 ft. 6 in.

KITSON ENGINE.

The writer regrets that he is only able to give the following dimensions and data of the competing Kitson engines, as no photograph is now available. Results, after some months' work, were much in favour of the Kitson engines, owing to their reliability and from a maintenance standpoint. The consequences were still further reaching, as the Queensland Government, who had decided in favour of the narrow gauge, vetoed the employment of the Fairlie double bogie—much to the chagrin of the inventor and his supporters. This will be dealt with later in relation to further experiences in this country.

PRINCIPAL DIMENSIONS OF THE KITSON ENGINES:

Cylinders	12 in. by 18 in.
Grate area	8·8 sq. ft.
Boiler ..	3 ft. 4¾ in. dia., 8 ft. 8½ long.
Firebox shell ..	4 ft. 1 in. long.
Wheels—	
Bissel bogie.. ..	2 ft. 0 in.
First pair leading ..	3 ft. 3 in.
Driving	3 ft. 3 in.
Trailing	3 ft. 3 in.
Number of tubes ..	112; 1¾ in. dia.
Heating surface—	
Firebox	55·8 sq. ft.
Tubes	461·6 sq. ft.
Total ..	517·4 sq. ft.
Wheel base—	
Fixed	9 ft. 2½ in.
Extreme	12 ft. 7½ in.

Weight of engine when loaded about 22 tons.

[Mr Weatherburn's next Contribution will appear in the June issue of the RAILWAY MAGAZINE.]

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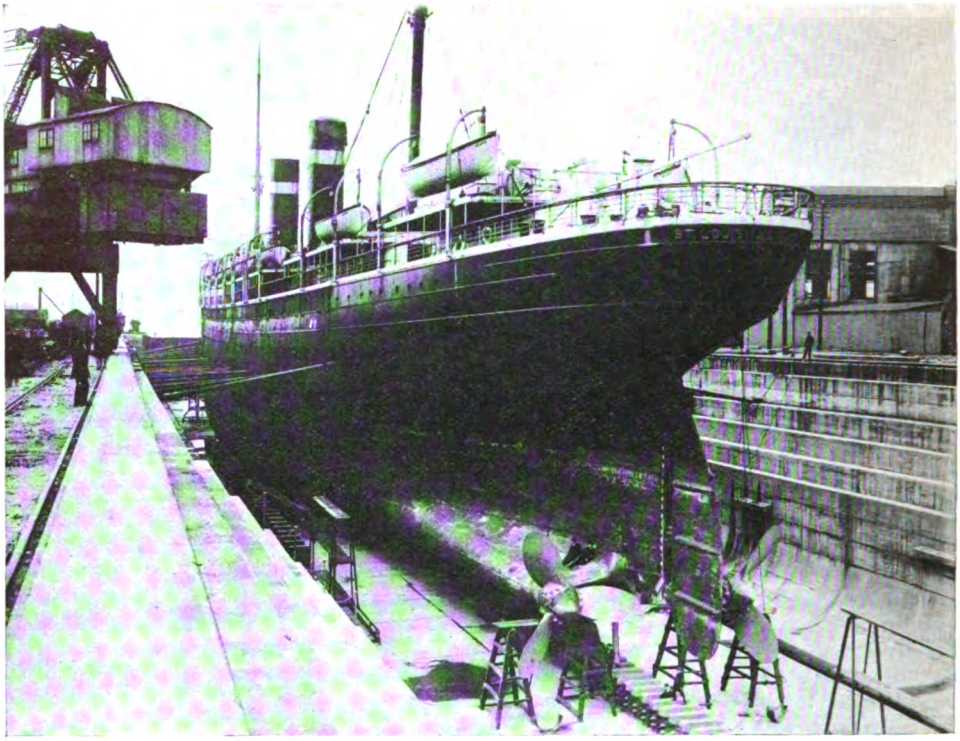

Photo] [*Topical.*

STEAMSHIP ST. LOUIS IN THE ENLARGED TRAFALGAR DOCK, SOUTHAMPTON, 4 APRIL, 1913.

Re-Opening Trafalgar Dock, Southampton.

AN engineering feat of considerable importance has just been completed at Southampton in the enlargement of the London and South Western Company's Trafalgar dry dock. When this graving basin was opened on Trafalgar Day, 1905, its principal dimensions were—length, 875 ft., width 90 ft., depth over cill 33 ft., and it was capable of receiving any vessel then afloat. The tendency of shipping in recent years has been in the direction of still larger tonnage, and the Company, realising that a dry dock of even greater dimensions would be required, determined, with characteristic enterprise, to anticipate the need. At first the construction of an entirely new dock was proposed, but eventually it was decided to enlarge the Trafalgar; and now, after two years of complex engineering work, the Company boasts the possession of a dry dock large enough to accommodate even the mammoth "Olympic," of the White Star Line, which makes Southampton her home port. The new dimensions of the dock are :—

Length	897 ft.
Width at entrance	100 ft.
Width inside lowest altar ..	102 ft.
Depth over cill at H.W.S.T...	35 ft.
Depth over blocks	33 ft.

If necessary, the blocks can be lowered to take a vessel of deeper draft.

Widening from 90 to 100 ft. has been effected by cutting away the face of both walls and setting back the altars, heavy counter-forts being built at the back of the existing walls to compensate for the weight thus lost. After the walls had been cut away, they were refaced with thin concrete walls, reinforced with expanded steel, and secured to the existing walls by numerous steel ties. The old gates have been removed, and

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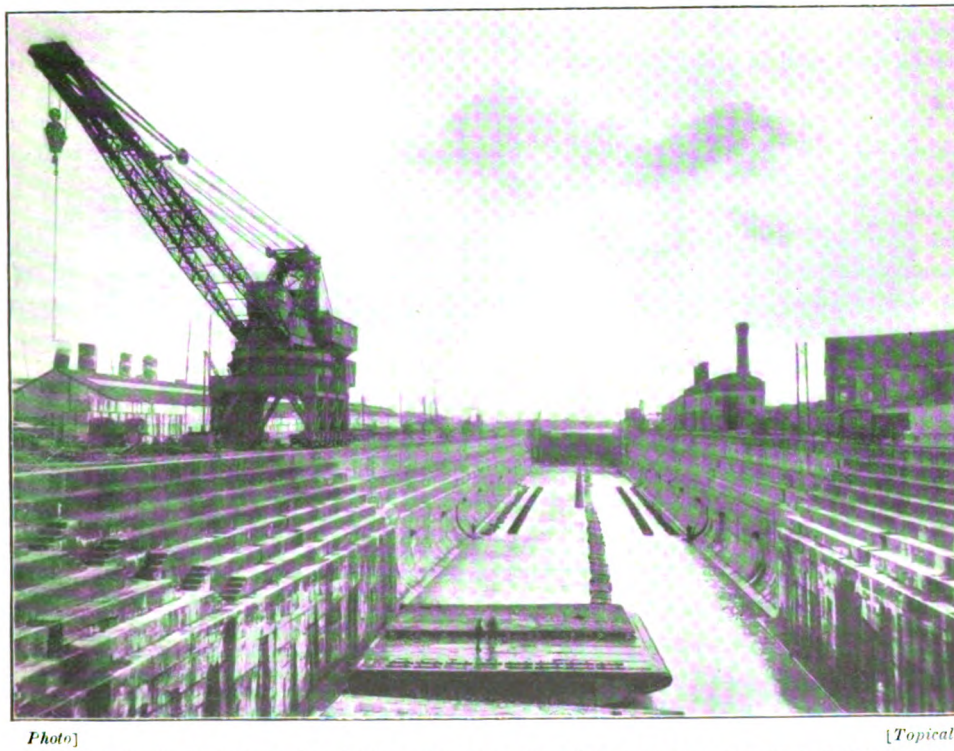
replaced by a sliding caisson, which, being double-faced, is capable of holding up the water level inside the dock while the tide is falling. This arrangement has hitherto been considered unnecessary at Southampton, as there are two hours of high water in which to dock vessels, but it has been thought advisable to introduce the improvement mentioned in case any unforeseen delay should occur when docking the very large vessels that now frequent the Port. Should such a delay be experienced, it will be possible not only to maintain the level of the water, but also to raise it if required. For this purpose a special pump, supplied by Messrs. Gwynnes, Ltd., has been installed, to force water into instead of out of the dock. Built by Messrs. Sir Wm. Armstrong, Whitworth & Co., the new caisson contains about 700 tons of steelwork. It moves on a pair of steel slide paths, and is drawn across the entrance by means of two hydraulic engines, having a combined pull of 50 tons. To permit the passage of a vessel into or out of the dock, the caisson is drawn back into a camber or recess, which has been specially built for the purpose. Surrounded by concrete walls, this camber can, if necessary, be used as a dry dock in which to effect repairs to the caisson itself. A complete set of heavy cast iron bilge and keel blocks have been provided instead of the old timber blocks, which were not considered strong enough to take the very heavy vessels that will in future make use of the dock. Both the discharge and filling culverts have had to be diverted, new tunnels being cut in the solid concrete walls for this purpose.

The contract was let to Messrs. Topham, Jones & Railton, Ltd., who provided some very fine plant for carrying out the work, including a complete outfit of pneumatic tools, worked by compressed air from a central station. These tools obviated the employment of explosives, which might have caused damage to the walls and floor, it being possible with them to cut away the old concrete walls both in the open and under the water. When closing the entrance the new caisson rests in a groove, the sides of



Photo] [*Topical.*

THE ENLARGED TRAFALGAR (DRY) DOCK, LONDON AND SOUTH WESTERN RAILWAY, SOUTHAMPTON.

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which are formed of two stops or faces built of 4-ton granite blocks, one on the dock side of the caisson, the other on the water side. The caisson rests against one or other of these stops, according to whether water is being pumped into or out of the dock. As the site of these stops lay outside the existing gates, a temporary dam had to be constructed across the entrance, to exclude water from that portion of the dock where the stops were to be built. This dam consisted of 14 in. timber sheet piles, driven in a row across the entrance, and supported at intervals by timber struts, which were placed between the piles and the old gates, thus transmitting the thrust of water to the latter. As soon as this dam was erected, the water was pumped out from the space between it and the old gates, and the new stops were built in position, the concrete being first cut away to form a bed for the granite.

One of the most difficult parts of the work was the construction of the camber or recess into which the caisson is drawn back to allow ships to pass into the dock. The trenches for this work had to be sunk in running sand, and in order to carry on the excavation it became necessary to surround the whole of the entrance walls with interlocking steel piling, driven in front of the entrance walls to a depth considerably greater than their foundations, forming a solid curtain of steel through which water or sand could not possibly pass. This curtain was then covered over with a blanket of strong impervious clay. The clay and the piles together formed a complete protection to the existing walls, and permitted the excavations to be carried on in perfect safety. After the new work had been completed, it was necessary to remove these protection works. Clay was excavated by dredger and grab; the old gates were floated off, and sunk to the bottom of the dock, ready for cutting up and removal. The timber piles which formed the temporary dam were bored off by divers armed with portable pneumatic drills. Many of the steel piles projected above ground level, and in preference to drawing them out—a process that might have weakened the adjoining walls—the top part of the piles which fouled the fairway were cut off by an ingenious arrangement consisting of a strong circular saw working on a frame bolted to the piles. This saw was worked by a pneumatic sector and controlled by the drivers, who also fixed and shifted the frame as required. The following figures give some idea of the amount of material made use of in carrying out of these works:—Excavation, 30,000 cubic yards; timber piles 20,000 cubic ft.; cutting away old concrete, 14,000 cubic yards; new concrete, 25,000 cubic yards; new granite, 12,000 cubic ft.; steel ties, 1,000 tons; steel piles, 260 tons; cast iron keel blocks, 780 tons. About 300 men were employed.

The American Line steamship "St. Louis" entered the dock on Friday, April 4th last, being the first vessel to take advantage of these enlarged and greatly improved repairing facilities.

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Modern Racecourse "Specials."

THE railway arrangements in connection with the "Grand National" race traffic were described by the RAILWAY MAGAZINE in March, 1906. Since then important developments have been witnessed, and brief reference to the traffic dealt with this year will be of interest. Three stations were concerned—two on the Lancashire and Yorkshire Railway, and one on the Southport branch of the Cheshire Lines Committee's Railway. Sefton Arms station (Lancashire and Yorkshire Railway), usually known as "Aintree," is situate on the main line from Liverpool to Preston, while the "Racecourse" station is, strictly speaking, a platform on the branch from Fazakerly to the North Mersey goods station at Alexandra Dock. The Cheshire Lines station is close to Sefton Arms, but all three stations are located very conveniently to the racecourse, and Aintree sidings are largely utilised by the Lancashire and Yorkshire Company for stabling special trains.

As regards local traffic, the Lancashire and Yorkshire and Cheshire Lines Railways are chiefly affected. At Sefton Arms station 57 trains were dealt with, and at the Racecourse station 34 trains, or a total of 91, of which 45 were electric. To Aintree (Sefton Arms) station, between the hours of 11 a.m. and 2 p.m., the following electric trains ran: 28 *ex* Liverpool, 6 *ex* Dingle, 5 *ex* Bankhall, and it was estimated that the number of people conveyed therein was about 20,000. The electric trains consisted of seven ordinary first-class carriages and three third-class carriages. The remaining steam trains which went to Sefton Arms station conveyed upwards of 4,500 passengers.

Photo] [*F. E. Mackay.*

THE 9 A.M. AINTREE SPECIAL: LONDON AND NORTH WESTERN RAILWAY.

Drawn by new four-cylinder engine, No. 2222, *Sir Gilbert Claughton.*

With respect to the trains arriving at the Racecourse station, upwards of 10,000 passengers were brought. The total of 91 trains represented the running of trains every two minutes between the hours of 11 a.m. and 2 p.m., and upwards of 200 additional staff of all grades were required to cope with the traffic.

In the case of the Cheshire Lines Committee, 77 specials were dealt with at the five platforms at Aintree, arriving from Manchester, Chester, Liverpool, Stockport, Cleethorpes, Sheffield, Leeds, Barnsley, Derby, Burton, Birmingham, Bristol, Leicester,

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Nottingham and London, by the routes of the three parent companies, Great Northern, Great Central, and Midland. Many of the trains were double-headed, and the number of passengers was probably a record for this meeting. Eleven of the trains included dining cars.

The London and North Western, Great Central, and Midland Companies ran through trains to Aintree from London and other centres, while the Great Northern and other railways were concerned in certain special arrangements for the race meetings at that popular centre. In the case of the London and North Western elaborate provisions were made this year. On Wednesday several ordinary trains were duplicated, and the train passing Wembley, specially taken by Mr. F. E. Mackay, is reproduced on page 409, but unfavourable weather prevented a result altogether up to our photographer's usual high standard. This train was booked non-stop to Wigan Junction, being allowed 3 hours 46 min. for the run of 194 miles. The load consisted of a brake composite and a first-class carriage for ordinary passengers, the remaining accommodation being reserved for passengers holding combined rail and luncheon, tea and dinner tickets. This included six twelve-wheeled dining cars and two eight-wheeled cars, with a six-wheeled brake at the rear. Every seat was occupied. Combined tickets were issued by the rest of the trains. The 7.15 had six cars and five other vehicles; the 7.35 nine cars and

SPECIAL ELECTRIC TRAIN, USED FOR AINTREE RACE TRAFFIC: LANCASHIRE AND YORKSHIRE RAILWAY.

excursion bookings given by the 12.15 p.m. *ex* Euston. The 12.10 and 5.55 p.m. trains were duplicated, and the 2.40 p.m. ran in four portions. On Thursday, in addition, a special portion of the 12.5 (midnight) train consisted solely of first-class sleeping cars. On Friday, third-class excursion trains, all with restaurant cars, left Euston at 7.15, 7.35, and 7.50 a.m. First-class restaurant car excursions started at 8.5 and 8.15 a.m. All called at Willesden, and were then booked non-stop to Wigan Junction, where Lancashire and Yorkshire pilotmen were taken.

At 9 a.m. a special first-class train, at ordinary fares, left Euston, and this was hauled by the new four-cylinder engine No. 2222, *Sir Gilbert Claughton*. A photograph of two other vehicles; the 7.50 and 8.5 each ten cars and two vehicles; and the 8.15 seven cars and three other vehicles. Special seating accommodation, apart from ordinary compartments, was respectively 155, 279, 261, 173, 172, and 164. All these trains ran to Aintree (Racecourse) station, and corresponding services were available for return, while on Saturday and Sunday special provision was made for homeward passengers. Comprehensive arrangements were also made to meet the needs of Birmingham and other cities.

For the special trains mentioned combined rail and luncheon and dinner tickets were issued. By the 7.15, 7.35, and 7.50 a.m. trains the inclusive charge was 21s. for third-class rail, breakfast and dinner;

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(F)

London & North Western
RAILWAY.

GRAND NATIONAL
STEEPLECHASE.

No. .....

Combined Rail and Refreshment Ticket.

LONDON to AINTREE AND BACK.

FIRST CLASS.

AVAILABLE ON 4th APRIL, 1913, ONLY,
by 9.0 a.m. train from Euston.

No money paid for this Ticket will be refunded unless the complete Ticket is returned to the Enquiry Office at Euston on or before April 2nd, 1913.

FRANK REE.
General Manager

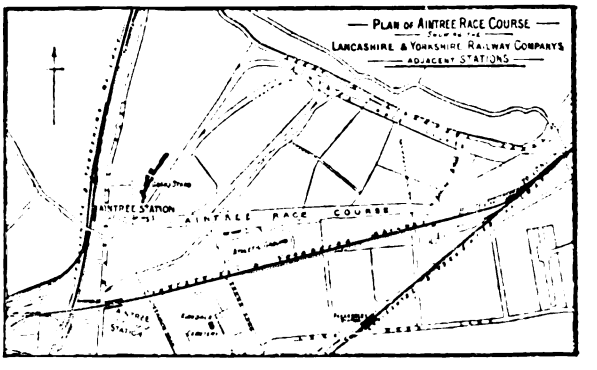
COMBINED FARE, 64/-

FRONT COVER OF LONDON AND NORTH WESTERN RAILWAY COMBINED RAIL AND REFRESHMENT TICKET FOR THE "GRAND NATIONAL" SPECIAL TRAIN, 4TH APRIL, 1913.

by the 8.5 and 8.15 a.m. trains, first-class rail, breakfast, tea and dinner tickets were issued at 38s. 6d.; and for the 9 a.m. ordinary first-class fares, plus luncheon, tea and dinner, cost 64s. Some of the trains were restricted to the holders of combined tickets; others took passengers booking for the journey only, at 16s. third-class excursion, 32s. first-class excursion, as well as those with two, three or four-day tickets to Aintree, Liverpool or Southport. In the special trains, for which combined tickets were issued, each seat was numbered. Books of coupons were employed, and the cover of one of these is here reproduced. Inside were coupons to be given up on the outward and homeward journeys and during the respective meals. The large number of restaurant cars required for these trains imposed a heavy strain upon the resources even of a railway like the London and North Western. The return specials left the Racecourse station at 4.30 (equivalent to the 9 a.m. down), 4.45 (first-class only), 5.30 and 6 p.m. On Saturday and Sunday the ordinary trains were duplicated as required.

The Great Central arrangements included special express trains, for which combined tickets were issued covering luncheon on the outward journey, with tea and dinner on the return. A first-class special left Marylebone at 7.32 a.m. on the Friday, and for this the inclusive fare was 38s. 6d. Another train, conveying third-class passengers only, left Marylebone at 7.10 a.m., the combined fare being 21s. For these trains the seats were numbered, and tickets issued to correspond. On Wednesday a special dining corridor express ran to Southport, with bookings to Liverpool for three or four days, leaving Marylebone at 1.15 p.m., third-class return fare 21s. Return trains left Aintree on Friday at 5.5 p.m. (first-class) and 5.20 p.m. (third-class), with a special on Saturday from Aintree at 4.5 p.m. The 7.10 a.m. special, travelling *viâ* Aylesbury and Throstle Nest Junction, was due in Aintree at 12.30 p.m., while the 7.32 a.m. train went *viâ* Aylesbury and Godley, arriving in Aintree at 12.40 p.m. Up specials were due in Marylebone at 10.25 and 10.40 p.m., respectively, while the Saturday train arrived at 9.5 p.m. Southport and Liverpool tickets were available for return from Aintree.

Midland arrangements were equally comprehensive. On April 2nd a corridor restaurant car express for Liverpool and Southport left St. Pancras at 2.30 p.m., with excursion bookings covering the period



AINTREE RACECOURSE: PLAN SHOWING LANCASHIRE AND YORKSHIRE RAILWAY CONNECTIONS.

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of the Liverpool Spring Races. On the Friday a third-class train started from St. Pancras at 8.5 p.m., followed by first-class trains at 8.20 and 8.30 a.m. These were due in Aintree at 12.50, 12.54 and 1.7 p.m., respectively. For the return a special express at ordinary fares (first and third-class), leaving Aintree at 3.38 p.m., was due in St. Pancras at 7.55 p.m., while the return specials were booked at 4.40 and 4.50 (first-class) and 5.15 p.m. (third-class). On the Saturday, "Limited" return specials left Aintree at 4 p.m. (first-class only) and 4.10 p.m. (first and third-class). Instead of issuing combined tickets like the London and North Western and Great Central, the Midland arranged for "Midland Special" luncheons and dinners to be served, tickets being issued as usual by the car conductors. Owing to the close proximity of the Lincoln and Liverpool Spring Races, a special feature was made of corridor restaurant car expresses from one centre to the other. On Wednesday this train left Lincoln at 5.10 p.m., for Liverpool, Manchester, Aintree and Southport. In addition to the services from London, special restaurant car trains at excursion fares were run on the "Grand National" day from St. Albans, Harpenden, Luton, Bedford, and other stations *en route* for Aintree, and similar facilities applied to the principal branch lines, as also to the West to North main lines.

During the hours when these special trains were running, goods traffic was, as far as possible, suspended, altered or diverted, while many ordinary passenger trains on both the Cheshire Lines and the Lancashire and Yorkshire Railways were necessarily modified. In the case of the latter railway, the Aintree sorting sidings and gridirons were very useful, as the long distance specials had only to proceed from the Racecourse station and shunt into one of the numerous lines thus rendered available, the engines going to the sheds and returning to their trains as convenient, ready for the homeward journeys. The position of each train was settled beforehand, so that everything worked quite smoothly. The electric trains between Liverpool and Aintree and the to-and-fro services between Manchester and other adjacent centres and Aintree were kept as clear as possible of the long-distance trains.

At Liverpool (Exchange) two platforms were set apart for the electric trains, barriers being erected to separate first and third-class passengers, who followed distinct routes to reach the respective portions of the trains. In make-up the electric trains were arranged with the same object, and green and white flags were fixed at the terminus to indicate the exact positions where they were required to be brought to a stand. At Aintree the respective classes were similarly kept distinct, to avoid confusion. Among the long-distance specials dealt with by the Lancashire and Yorkshire Railway other than the London and North Western trains from London already reviewed, may be mentioned through Lancashire and Yorkshire trains from all parts of the system, London and North Western trains from Northampton, Leamington, Birmingham, North Wales and Chester, and North Eastern trains from Bridlington, Hull and other destinations, most of them worked through by their own engines. Trains from the Furness system were brought by London and North Western engines.

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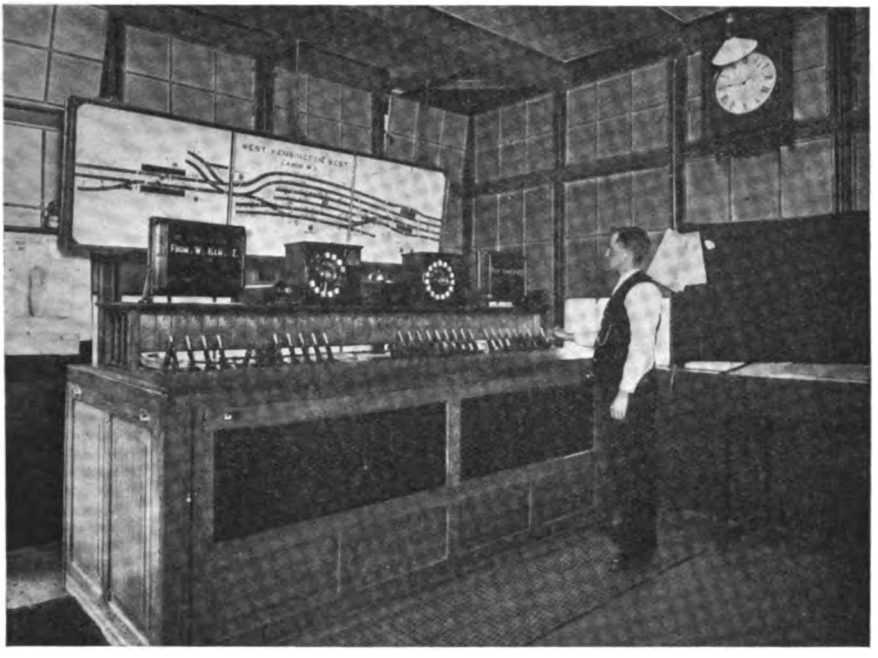

WEST KENSINGTON WEST CABIN: METROPOLITAN DISTRICT RAILWAY.
Showing power signalling frame and illuminated diagram.

Underground Railway Traffic in New York and London.

MANY of our readers are no doubt familiar with the general features of the well-known "Subway" in New York, of which our Transatlantic contemporary, the *Railroad Man's Magazine*, publishes particulars. Built as close to the road surface as possible, the line was designed to accommodate a maximum of 400,000 passengers per day, but last year it carried on an average more than 900,000. The "Sub," as it is familiarly called by New Yorkers, cost about $75,000,000. It is 26·3 miles long, and has 85·2 miles of track. The new subways and rapid transit lines under construction —some of which are almost ready for operation—will extend 104 miles throughout Greater New York, have 309 miles of track, and cost nearly $300,000,000. The existing subway consists of a four-track trunk line from Brooklyn Bridge to Ninety-Sixth Street—about six miles. At Ninety-Sixth Street there are two branches, one running up Broadway to Van Cortlandt Park—a little more than seven miles—the other, the Lennox Avenue branch, extending to Broux Park—about nine miles. Portions of both these northern branches are carried on elevated structures, and each has two tracks. Express trains on the four-track division stop only at Brooklyn Bridge, Fourteenth, Forty-Second, Seventy-Second, and Ninety-Sixth Streets. Express trains run on the inside tracks, and the locals, which stop at all stations, on the outside ones. South of Brooklyn Bridge the line runs to the lower end of Manhattan Island, then under the East River, and forward to Brooklyn. Its terminus is Atlantic Avenue, between four and five miles from Brooklyn Bridge. This part of the system is a two-track line, but the width of the four-track section of the Subway is 54 ft. 8½ in. The original cars had end doors only, 28 inches wide. These were enlarged to 38 inches, and newer steel cars have 50 in. end and middle doors. The express platforms now take 10-car trains, while the local platforms accommodate 6-car trains. Celerity of train control and operation is, of course,

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a necessity for such traffic. Electro-pneumatic Westinghouse brakes and a special signalling system enable present conditions to be realised. The signals are set by clockwork, so as to remain at danger for a certain number of seconds after the first has shown clear. Exact running time is carefully fixed for each block. A train that is to run at eight miles an hour will take an exact number of seconds after it passes the first point to reach the second, and the second signal is set to remain at danger for that number of seconds after the first has shown clear. Should the motorman come along at 12 miles an hour, he reaches the second signal before it is clear. The automatic trip then comes into play, and he is stopped unless he obey the signal. The third-rail system of current distribution is employed, alternating current at 11,000 volts in the power station, and transformed to 610 volts direct current for the track rails. During the "rush" hours trains are run 90 secs. apart. It is not unusual for the hundreds of trains that speed to and fro in these three-hour periods morning and evening to be handled exactly to schedule without a fraction of a minute being lost.

With the exception of the double tracks for fast and stopping trains—unfortunately not yet introduced in London—it will be recognised that the New York ideal has already been reached, if not actually improved upon, in the case of our own Underground Railways, which, under their present efficient system of management, have made extraordinary progress. Geographical conditions are not nearly so severe on the New York Subway as those affecting the Metropolitan District. The former consists simply of a "Y" line, so that it is only necessary to fit in trains from two different lines, running, as Americans say, to a "stub" end. But upon our own District Railway the trains emerge from a congeries of roads, and go out in as many more directions. Yet, notwithstanding this serious difference in the conditions of daily traffic, Mr. W. E. Blake, the Superintendent of the District Railway, has succeeded in fitting the trains in at intervals of only 90 secs., which is a very great achievement.

The same Company may be further congratulated that they did not in the first instance make the mistake of providing only end doors to their cars, experience having conclusively proved that those fitted with middle, as well as end, doors, are much better adapted for a heavy traffic, with numerous brief stops. This advantage was, indeed, conclusively demonstrated when, for the purposes of experiment, a party of travellers were from one station loaded into two consecutive trains—one composed of steam stock having Southend as its destination, the other, an ordinary electric car train, with middle as well as end doors. The latter literally "swallowed" its load in about half the time occupied in getting the same complement of passengers into the steam train, which was, of course, supplied with a door to each compartment. While the signalling for express roads is the same on the New York Subway and the Metropolitan District, the time control system of the former is unique; but, on the other hand, the District possesses a distance limit system which is equally effective. The latter has involved the installation at the busiest stations of three home signals on each road, the effect of which arrangement is that as train "A" leaves, train "B" gradually draws in, although it has never been less than 400 ft. from "A." In point of fact "B" runs in with perfect freedom, and is not checked. The New York system enables train "B" under control to come up closer to "A," while the District system requires that there shall always be the same space between trains running on the same road. On the New York Subway the current distribution is almost exactly the same as on the District; but there is, at least, one great difference between the two lines, in that the former has to carry a much denser traffic than that which has up to the present been encountered on the latter. This is, of course, due to the fact that owing to the configuration of New York City, the Subway was, until recently at any rate, the only railway up and down, while in London, as everybody knows, there are, quite apart from steam lines, no fewer than eight tubes and electric lines running in different directions.

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THE NEW KIUL BRIDGE, EAST INDIAN RAILWAY.

East Indian Railway: The Kiul Bridge.

WE have to thank Mr. A. Murdock, of the Traffic Department, East Indian Railway, for excellent photographs which he has been good enough to forward from Sakzigali, where, as in many other parts of India, the RAILWAY MAGAZINE is eagerly read every month by a large number of persons. Mr. Murdock, who was the guard of the train seen in one of the illustrations, took the pictures himself, and he kindly supplies the following account of an engineering performance which is well worthy of record.

"A very smart piece of work was recently completed in re-girdering the 'up' road of the Kiul Bridge, at mile 261⅞, on the main line of the East Indian Railway within three months of starting work. But this fine record has been surpassed in re-girdering the 'down' road. The old bridge consisted of nine spans of 150 feet lattice girders, weighing 141 tons per span, with footways supported on brackets on the outside girders. Before the work of erecting the new girders could be put in hand, the old girders had to be dismantled, involving the cutting out of 103,000 rivets. The piers were demolished, and fresh bed stones set at a lower level for the reception of new girders. These girders are of the open 'N' type of 150 feet clear span, and were designed by Sir A. M. Rendel and Mr. F. E. Robertson, Westminster, London. Each girder weighs 160 tons, and 15,000 rivets per span were required in their erection. The work of dismantling the old girders of the 'down' road was started on November 14, 1912, and the track was laid across the new bridge on January 11, 1913. The officers in charge of the work were Messrs. A. H. Aslett, A.M.I.C.E., District Engineer of the East Indian Railway; Mr. J. Leitch, M.Am.S.C.E., Resident Engineer; Mr. C. O. Meredith, Bridge Foreman; and Mr. Maurice Melling, contractor."

Mr. A. H. Aslett is the nephew of Mr. Alfred Aslett, the well known Secretary and General Manager of the Furness Railway.

LOOP MAIL TRAIN READY TO CROSS THE KIUL BRIDGE ON SINGLE LINE, WHILE RE-GIRDERING WAS BEING CARRIED OUT.

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Oversea Trade of the Hull and Barnsley Railway.

FROM its opening in 1885 until 1889, the Hull and Barnsley Railway—which at that period had a longer title — passed through many commercial and financial vicissitudes. In the latter year the borrowing powers of the Company were re-organised and its history has since been one of steady and continuous development. The progress of the line has been particularly marked since 1905, when the railway received its present title, and came under the management of Mr. Edward Watkin, who, as all the railway world knows, is a nephew of the late Sir Edward Watkin. At the date of opening, in 1885, the mileage of the line was 66 miles. Ten years later it was 75 miles; but to-day, including "foreign" lines worked over, it is 94½ miles. Further evidence of progress is seen in the fact that, while in 1905 the dividend paid on the ordinary stock for the year ending December 31st was only 1⅜ per cent. per annum, the corresponding dividend for 1912 was at the rate of 3 per cent.

Although the Hull and Barnsley Company own the Alexandra Docks—and it is with the oversea traffic of the railway that we are at the moment mainly concerned—it must not be imagined that operations are confined to imported and exported traffic. On the contrary, the system provides facilities for a considerable local trade and for a passenger traffic in some years exceeding half a million journeys, exclusive of those made by season ticket holders.

Originally 46½ acres in extent, the Alexandra Dock was, in 1899, extended by the opening of another connecting dock of 7 acres. The latter, largely used for the importation of pit props and the exportation of coal, is equipped with the most modern coal-shipping appliances. The Alexandra Docks are indeed to-day the premier docks of the Humber. They are the "home" of ocean-going steamers maintaining fixed services with the colonies and foreign countries, there being fortnightly sailings to the Straits Settlements, China and Japan, the Far East, the Black Sea, India and the United States, as well as three-weekly sailings to Canada, and monthly sailings to Australia and South America.

Spacious quays, possessing rail connection, commodious warehouses, transit sheds, cold stores, cellars and timber storage grounds upon or contiguous to the quays,

A BUSY CORNER OF THE ALEXANDRA DOCKS, HULL.

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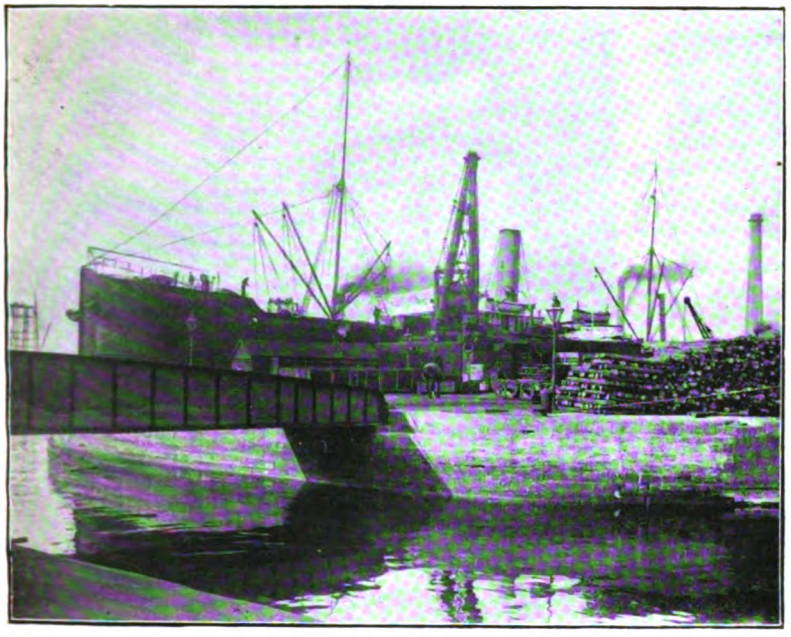

LOADING RAILWAY CARRIAGE WORKS FOR SOUTH AMERICA AT THE 100-TON CRANE, ALEXANDRA DOCKS, HULL.

quick-working and conveniently placed electric and hydraulic cranes capable of raising weights ranging up to 100 tons, modern coal-hoists, two large dry docks—all are eloquent proofs of the up-to-date character of the Alexandra Docks and of their adaptability to the requirements of present-day trade. Here come vessels bringing produce from every quarter of the globe—frozen meat from South America, wool from Australia, provisions from the United States, grain and seed from India, Russia and Australia, timber from the Baltic; while as regards exports, coal, bale goods, machinery, railway material, iron and steel, earthenware, oil, paint and colours form the main items of a continually growing business. Hull is the natural outlet and inlet for the traffic of a manufacturing and mining district bounded by Newcastle on the north, Halifax on the west and Leicester on the south—a district containing roughly from 10,000,000 to 12,000,000 inhabitants. The immense value of such docks and facilities is, therefore, obvious.

Appreciating the necessity of keeping well abreast of the commercial expansion of the port, the Hull and Barnsley Company have decided to increase the cranage power at the docks by introducing new electric cranes on the south side, and are now engaged in the work of completing the equipment of their river pier, where a commodious warehouse constructed of ferro-concrete, electric cranes, and capstans of the latest type are being provided, so that fruit, vegetables and other perishable produce, general merchandise passengers and transmigrants may be accommodated. Railway lines upon the pier connect with the Company's system, and the latter is linked to the main trunk lines of the kingdom, so that quick and uninterrupted transit is assured. There is a minimum depth of water alongside the pier of 18 feet L.W.S.T.

At the west end of the pier two electric belt conveyors for the rapid shipment of coal, each capable of shipping 600 tons per hour, have been in successful use for a considerable time. They are specially designed with the object of minimising the breakage of coal, and the telescopic spouts, reaching into the combings of the ship's hatchway, lessen the need for trimming. Shippers using these appliances are, therefore, able to effect substantial economies. Indeed, it has been authoritatively admitted that since the adoption of the belt conveyor system of shipping coal, the saving accruing to receivers abroad ranges from 4d. to 1s. per ton. The following record of the good work performed by these conveyors appeared in our contemporary the *Railway News* of December 14, 1912 :—

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Some instances of quick coal shipment at Hull by the modern plant provided by the Hull and Barnsley Railway Company have come to hand this week. The ss. *Zuid Holland* commenced coal loading at the River Pier at 11.15 a.m. on the 29th November, and took 2,700 tons of coal in seven and three-quarter hours, or an average of 350 tons per hour. The same boat was back at the conveyor on 4th December, when 2,700 tons of coal were loaded between 1 p.m. and 8.55 p.m., an average of 425 tons per hour.

DISCHARGING AUSTRALIAN WOOL—ALEXANDRA DOCKS, HULL.

The joint dock owned by the Hull and Barnsley and North Eastern Companies, which, with its modern electric coaling appliances, capacious grain silo and electric plant for the handling of grain cargoes, commodious warehouses, quick working electric cranes, (including a floating high-capacity crane) and large dry docks, is to be opened this year, will mark an important step in the advancement of Hull as an up-to-date port. Operations have also been begun by the Hull and Barnsley and North Eastern Companies in connection with a new jetty and oil haven at Saltend, which is situate to the east of the Joint Dock. The new jetty will extend into the Humber for a distance of 1,500 ft., and the largest type of tank steamer will be able to go alongside at any state of the tide, a depth of 30 ft. being assured. Except London, this will be the only place on the East Coast where large vessels containing petroleum giving off a vapour less than 75 deg. Fahrenheit can be discharged. For the storage of petroleum, about 120 acres of land will be available, and river, rail and road connections will be provided, together with an installation of the latest facilities for dealing with the oil. Arrangements have already been made with one or two large oil firms, and negotiations are proceeding with others, so that the prospects of there establishing an important distributing centre for petrol, motor spirit and other oils are decidedly good.

DISCHARGING GRAIN AT THE ALEXANDRA DOCKS, HULL.

CRANING MEAT DIRECT FROM SHIP TO COLD STORES: ALEXANDRA DOCKS, HULL.

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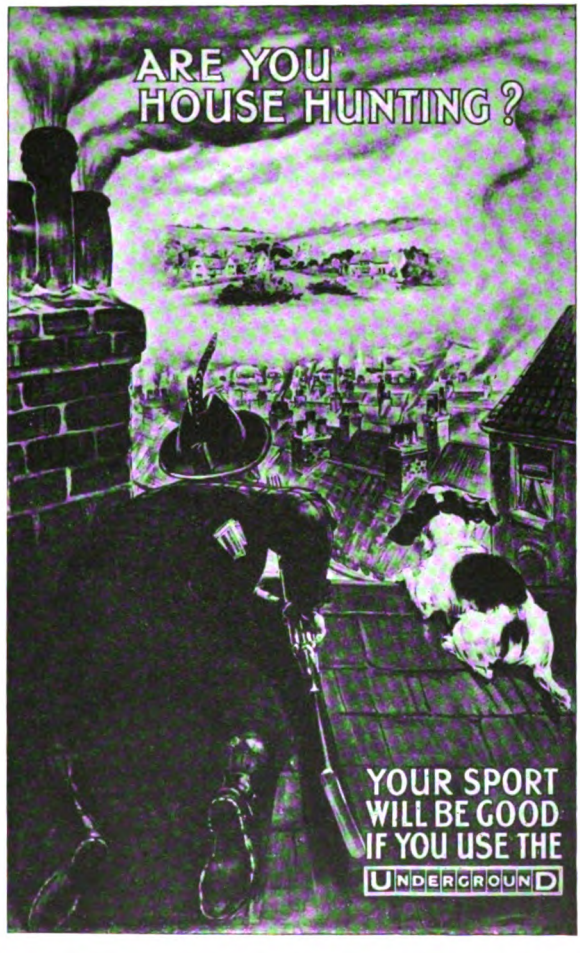
Modern Posters on the UndergrounD.

NOTWITHSTANDING the high standard of artistic excellence achieved by the leading railways in recent years in respect of posters for exhibition at stations and other places, it is doubtful whether any system can show a more remarkable record than that associated with the Publicity Department of the Metropolitan District, London Electric, and allied underground lines. Indeed, the succession of posters issued from Electric Railway House would form more than the nucleus of a good-sized picture gallery, full of interest, and, withal, neither offending æsthetic taste nor unduly parading the fact that they are really designed as advertisements. Distinctiveness is always maintained, while at the same time every poster has its own characteristic features. It is unnecessary to add that leading artists have contributed to the variety and fascination of this Underground "Art Gallery." The pictures are in fact so much above the level of the ordinary output of earlier years that they attract public attention as soon as they appear, and win general admiration.



Some of these posters combine to form series, while others can be grouped in classes according to their purpose and subject matter, though all possess entirely distinctive features. Indeed, even on the score of variety wonderful results have been achieved. A series of the posters are now before us, and two are here reproduced as effectively as the process of black and white will permit. The illustration on this page contains good advice to those in search of a convenient, accessible and desirable residential district. Presumably the Tyrolean hunter is advised to discontinue his search through the crowded area of bricks and mortar. The Underground will take him to "fresh fields and pastures new"—to pleasant homesteads in rural or semi-rural surroundings; yet he will have all the facilities and advantages given by the Underground system of quick and frequent trains.

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The second illustration, on this page, conveys an entirely different suggestion, and we can anticipate that the poster will appeal to many young folk, its effect upon *paterfamilias* being perhaps by no means insignificant. Even yet many people in the Metropolis do not half realise the numerous pleasant country districts that the Metropolitan District and London Electric Railways have placed within convenient reach of the City. Two other posters constitute Nos. 2 and 4 of the "Humours of London" series, by "Tony Sarg." The former seeks to enforce the moral that in the British capital the best way to go shopping is by means of the Underground. The humours of a busy thoroughfare are well depicted, and the procession of laden messengers below is a happy touch in an ingenious conception. "Condensed country is like condensed milk," supplies the text of the second of these posters, the pictorial portion of which conveys the artist's ideas of "condensed country." Below, a lively farmyard is cleverly suggested, with an old farmer and his pig as a side issue.

Altogether different is the fifth poster. Herein is illustrated the return of Persephone to earth each year, bringing in her train the delights of Spring and Summer. The classic story is told in prose on one panel, and an apposite poetical extract occupies a contiguous space. Poster No. 6 corresponds to one of the leaves in the calendar issued at the beginning of the year, showing on a brown ground a bank of double almond blossom growing in Regent's Park, attention being drawn to the fact that many other parks are equally well served by Underground stations. These posters may be taken as indicating how well the Underground railways cater for every class of citizen. They are directing attention to the charms of the countryside, to the parks and other open areas, which they seem to link together, and enable people to see how easily they may reach the leading shopping centres of London. The last of the series under review is devoted to "Flying at Hendon." It shows one of the stands on the aviation ground with a flying machine, and the injunction given to visitors is that they should travel thither by motor-'bus (Services 13 and 83) from Golders Green station. These seven pictures may be taken as examples of a collection which we hope is not yet exhausted.

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Railway Nationalisation.

A RUMOUR was heard in certain quarters not long ago that when a general election next occurred in this country, one of the chief political parties would be found placing the Nationalisation of Railways in the forefront of its programme. As yet, there has certainly not been anything approaching official confirmation of this statement, and if the latest declaration of the Prime Minister be taken into account, the present Government, at any rate, cannot be suspected of having any such intention. As a good deal will no doubt turn upon the words last used by the right hon. gentleman, it is well here to place on record that, when replying to the deputation from the Parliamentary Committee of the Trade Union Congress which waited upon him at the House of Commons on the 17th March last, Mr. Asquith said :—

With regard to nationalisation, which has been presented to us from the point of view of application to mines and railways, I do not know that I have anything to add to what I said last year. As regards mines, I do not know whether Mr. Harvey, who has very special knowledge of the subject, has had his attention called to some information recently laid before Parliament with regard to the operation of nationalisation in Germany. It is not of a very satisfactory kind, and does not tend to encourage a very sanguine hope of what a repetition of the experiment made there would produce in this country; and when you have regard to the enormous variety of conditions under which our mining industry is carried on—I might also say the highly speculative ingredients which enter into the complexity of the whole system of production—I think you should have very considerable hesitation with regard to any proposal to transfer mines as going concerns to the hands of the State. But so far as railways are concerned Mr. Walkden has repeated to-day the interesting argument he used last year, and I quite agree that railways stand on a different footing from mines and most other interests. The State does control their operation in many directions, and it is quite true that Mr. Gladstone contemplated that under certain conditions they might be taken over by the State. That contingency has always been a possibility which those who invested their money in railway enterprise were entitled to contemplate. But I can only refer to what I said last year I do not think any of the observations I made then have lost force from our subsequent experience. There are practical difficulties of a very serious kind in the application of nationalisation to railways. I am quite sure that any such operation, carried out on reasonable and equitable terms, would be immediately followed by very large demands from two entirely different quarters—from traders for better terms in the matter of rates, and, on the other hand, from the railway workers for better conditions and hours of labour; and that prospective advance in net receipts which Mr. Walkden has been forecasting, and which very likely might come, would, I strongly suspect, be more than swallowed up before the railways had been in the possession of the State for more than twelve months. These are things which, looked at from the point of view of the taxpayer and the general community, you cannot leave out of account. You might get advantages from the reduction of competition and so forth. At any rate, I remain of the opinion which I expressed last year, that the burden of proof is on the shoulders of those who are in favour of this proposal. I have a perfectly open mind on the subject, but have yet to be convinced.

It must be frankly acknowledged that Mr. Walkden never fails to submit the best possible case that can be presented in favour of the State control of railways; but the evidence which, twelve months ago, the Prime Minister asked the Parliamentary Committee of the Trade Union Congress to supply is not yet forthcoming; and, so far as can be judged, there is no approach to a general desire in favour of such a step being taken by any Government.

In a comprehensive record of the economic development of France in 1910 and 1911, Mr. W. Gastrell, the British Consul-General in Paris, states that the State railway system of that country began in 1878, when a certain number of unimportant local railways were bought. "After some years of unsatisfactory administrative methods, the statements of the expenditure on and revenue from these lines were formed into a yearly supplementary budget, under Parliamentary control. Since 1895 a director, assisted by a consultative board, has been responsible for their management to the Minister of Public Works. By special provisions inserted in the Finance Law of 1911 the future method of administering all the State lines (which, since the purchase by the Government of the Western Railway on January 1, 1909, include the old system of 1,855 miles and the newly-acquired one of 5,540 miles) was definitely laid down. The Minister of Public Works now virtually controls them through a director and a council, the expenditure being looked after by

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an official representing the Ministers of Public Works and Finance. The accounts, however, for the old and new systems are entered in two separate supplementary budgets. The total network of the State lines is now 7,425 miles altogether. The old State railway system in 1900 brought in a revenue of £486,225, or £1·94 per cent. on a capital outlay of £25,038,080; the estimated return for 1912 is only £302,620, or £0·92 per cent. on a capital expenditure of £32,812,619. The highest return was in 1903, with £2·16 per cent. (£570,545) on £26,416,320. The new State railway system was bought on January 1, 1909, for £110,044,000, and its first year's accounts showed receipts of £8,717,600, and working expenses £5,588,000, giving a surplus of £3,129,600. As, however, £4,572,000 had to be paid (*a*) to the Western Company and (*b*) for charges on capital, there remained a deficit of £1,442,400. These deficits have gone on increasing, and are given as follows:—£2,078,448 in 1910, £2,245,320 in 1911, and £3,012,080 in 1912 (estimated)." It may be added that up to the present time electrification on the State lines has been confined to local lines.

The *Daily Telegraph*, which has preserved an impartial attitude on the subject of the Nationalisation of railways, recently made the following comments upon the latest report of the Western Railway of France:—

"It would seem that the State railway is not one of those things they manage better in France. Figures certainly point to that conclusion, and to whatever cause the failure be attributed—incapacity or inherent unsoundness—the fact remains that since the French Government rebought the Western Railway the State venture has become an increasing charge on the Exchequer. Domestic affairs of other countries can scarcely be expected to excite keen interest here; but the movement for the State purchase of railways is with us as much as with any other country, and there is therefore something to be gained by observing how national railways fare abroad. Though the Western Railway of France, rebought by the State in 1908, is an extreme instance, it is nevertheless worth consideration.

"The report for the year 1912 has been published, and has already furnished the subject of an interesting debate in the French Chamber, and though accustomed by now to expect some awkward situation, the Chamber is little short of appalled at the steady growth in expenses and the increasing deficit. Since 1908, when the railway was acquired from the company, the deficit has more than doubled. There is a limit to the patience even of the enthusiasts for State management, and that limit seems to have been reached.

"But let the figures first speak for themselves. Here they are:

(In Millions of Francs.)

	Gross Receipts.	Working Expenses.	Net Charges	Deficit.
1908 ..	219·6	148	98·7	27·1
1909 ..	219·3	149·4	108·7	38·7
1910 ..	229·6	172·5	115·6	58·4
1911 ..	236·1	206	101·5	71·3
1912 ..	244·3	222·4	106·3	84·4
1913 ..	251·8	225·7	116	89·9

"It is necessary to explain that 1909 is the first year of State management; that the 1911 results are provisional; 1912 figures are revised estimates, and those for 1913 the estimated totals. Though only an estimate, the fact that increased expenditure is anticipated points very clearly to the source of the trouble. The rise in operating expenses is tremendous, and wipes out the advance of 3·8 per cent. in the annual gross receipts. Let us analyse the expenditure (the figures as before represent millions of francs) and see on what items the increases fall.

	Wages and salaries	Other expenses.		Wages and salaries.	Other expenses.
1904..	65·4	.. 42·4	1909..	85·5	.. 63·8
1905..	67·9	.. 43·1	1910..	98·5	.. 74·0
1906..	70·5	.. 48·9	1911..	114·4	.. 94·6
1907..	74·2	.. 57·2	1912..	133·2	.. 89·2
1908..	79·1	.. 68·9	1913..	137·4	.. 88·4

"The main reason for the advance can no longer be in doubt. Higher remuneration for services is the influence. The trouble faces railway managers abroad just as it faces railway managers here. Only there is the tremendous difference, which these figures bear out, that while the movement in France took a normal course prior to 1908, the current has simply raced along since like a river approaching a cataract. The reason is obvious. The pressure that can be applied is one that cannot be resisted when only the national purse has to be considered, and the paymasters—the Government of the day—dependent upon the goodwill of their employés for their existence.

"France, however, does not seem to be in the mood to gratify the passion for increasing expenditure, and this tributary deficit, joining the main stream of increases in national expenditure, adds to the burdens, already very heavy. (in the past three years the Budget has increased £20,000,000.) The position is becoming serious. otherwise the writer of the report, an ardent supporter, to boot, of railway nationalisation, would never have permitted himself to pen the following conclusion. He says: 'It is evident that this state of affairs cannot be prolonged; it would make management

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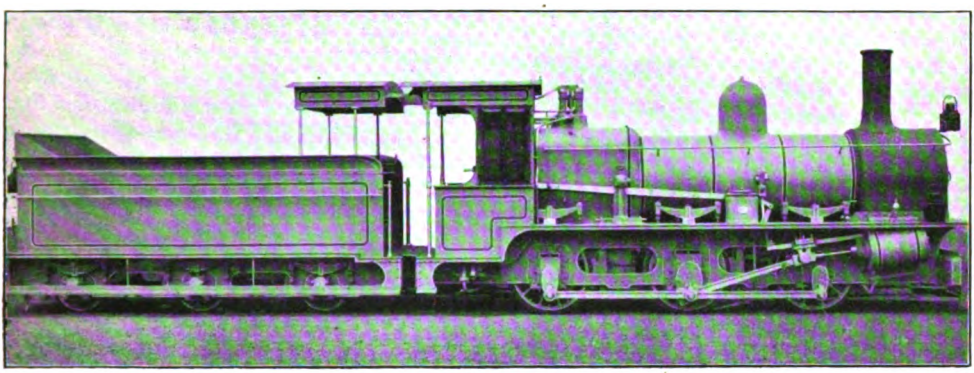
impossible, and it would be better for the State to renounce the working of its system rather than incur heavier deficits.'

"It will, of course, be argued that the services of the employés were inadequately paid prior to the acquisition; but, so far as it can be traced, the abnormal movement is not noticeable in other lines. Whether that be so or not, the burden is one which the railway cannot stand as a business proposition. When it is remembered that in three years 500,000,000f have been spent in rolling stock, etc., involving increasing charges to meet interest on obligations issued, it will be seen that operating expenses are not the only difficulty. There can only be one conclusion to this review: either the French show no capacity to manage national enterprises, or the State is in the grip of forces which make the demand for increasing expenditure irresistible."

On the other hand, the fact should not be overlooked that two General Managers of leading English railways—first Mr. F. H. Dent, of the South Eastern and Chatham, and more recently Sir Guy Granet, of the Midland—have given what must be regarded as a "friendly lead" to State control. Mr. Dent does not favour partial Nationalisation, but considers that it would be safer and better for the State to take over the whole of the lines. He is convinced that the existing clerical staff would be needed, and probably more, to compile the scientific statistics required by Parliament; but traffic operations could then be carried out more expeditiously and economically than is at present possible. Further, he is of opinion that great advantage would accrue from the use of a common rolling stock, as also from the absence of the existing necessity of sending "foreign" wagons home empty; and that there would also be an enormous reduction in shunting expenses. Sir Guy Granet believes that, if certain conditions were granted, Nationalisation might be made a commercial success; but he, like Mr. Dent, is careful to stipulate that if the State ever did propose to take over the management of the railways of the United Kingdom, the bargain would have to be perfectly fair to the companies.



METRE-GAUGE GOODS ENGINE: NIZAM'S GUARANTEED STATE RAILWAY, INDIA.

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Continuous Stroke Indicator Diagrams.

CONSIDERABLE interest is being evinced by leading railways in the new indicator attachment for obtaining continuous diagrams which the Crosby Steam Gauge and Valve Company have introduced. Known as the Wallace patent, this continuous stroke diagram attachment provides a means of obtaining indicator diagrams simultaneously from each end of an engine cylinder, properly co-ordinated by means of an automatic stroke recorder. An electrical or mechanical timing device may, if desired, also be added.

The ordinary indicator diagram is commonly accepted to be a measure of the work done on an engine piston during two strokes or one complete revolution of the crank shaft. Actually, however, the diagram represents, in most cases, the work done on only one side of the piston for one stroke, and on the other side for the return stroke, during any one revolution. To determine the actual work done it is necessary to have diagrams taken from both sides of the piston simultaneously. When it is required to know the work done during any revolution of the crank shaft or any stroke of the piston, over a given period, the diagrams must be taken from both sides of the piston, not only simultaneously, but also continuously over the given period. They must also be obtained in such a manner that the diagram taken at any instant on one side of the piston may be co-ordinated with the diagram at the same instant from the other side of the piston. By means of the attachment, stroke diagrams in strict accordance with these requirements may be obtained, and their value will be at once apparent.

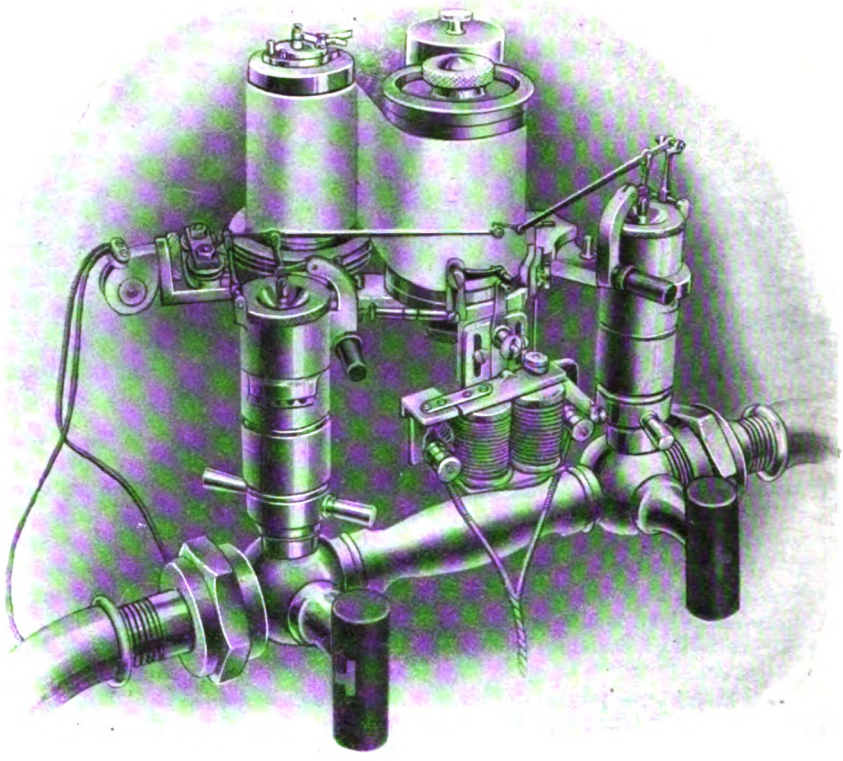

Fig. 1.

This attachment may be fitted to any two Crosby indicators, whether of the inside or outside spring type. Fig. 1 shows that it consists essentially of two parts—(1) a stationary magazine drum, which holds a roll of paper about 100 ft. long, fitted upon a bracket arranged to couple the two indicators together, and (2) a special clutch drum which has to be mounted instead of the ordinary drum on one of the indicators to which the attachment is

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fitted. This drum is actuated in the usual way from the engine reducing gear, but moves in only one direction, withdrawing the paper strip from the magazine drum and winding it on itself. The indicator paper is therefore made to move continuously in one direction and with a speed at all times proportionate to that of the engine piston.

A double three-way cock connection is supplied to receive the two indicators, and this is so designed as to allow of either indicator being put in communication with either end of the cylinder, or opened to the atmosphere. When continuous diagrams are being taken, each indicator is put in communication with the end of the cylinder nearest to it; but if it be desired to take ordinary diagrams these may be obtained on the indicator drum which was not dismounted, and this indicator can at will be put into communication with either end of the cylinder.

diagram being taken, draw lines perpendicular to the atmospheric line at the points corresponding to the ends of the stroke as shown by the stroke record—X-1, X-2, etc. The form of the stroke record differentiates one stroke from another. Therefore by a simple inspection at the time of the diagram is taken or at any time if the method of connecting the attachment to the reciprocating part of the engine, be known, from the position of the record "up" as at 2-3 or "down" as at 3-4, the corresponding stroke of the engine piston, "forward" or "backward," or "up" or "down," as the case may be, may be determined. The perpendicular distance between the two steam pressure lines represents, to the scale of the indicator spring, the effective pressure on the piston at any part of its stroke.

The area A B G (Fig. 2) represents the work done on the piston, and the area B N C the work

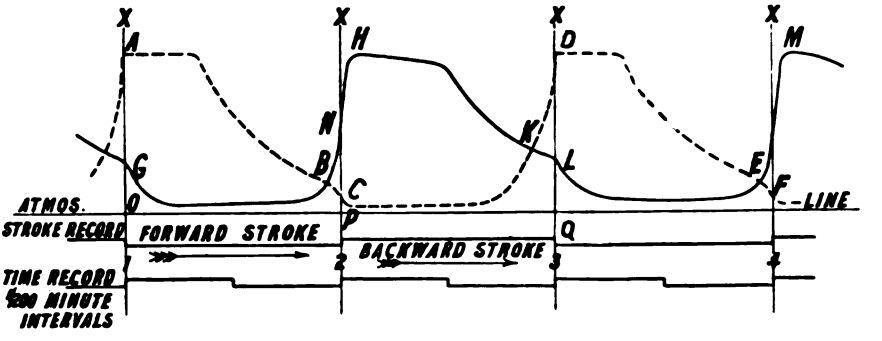

Fig. 2.

This connection fixes the indicators at the right distance apart to receive the attachment, and allows of the indicator pencil levers being brought as close together as possible without touching. The resulting diagrams are not of the closed form characteristic of the ordinary diagrams, but appear as two sinuous lines crossing and recrossing each other, and are such that the distance between the lines at any point represents the effective pressure, either positive or negative, on the piston at that moment. The position on these stroke diagrams corresponding to the end of the stroke of the engine may, on account of faulty valve setting, not be self-evident, but the stroke recording device provides a means by which this can be accurately known. It also eliminates any error that might arise from the slight lengthening of the diagram due to the increased thickness of the paper on the clutch drum as it is wound up on it.

Fig. 2 illustrates continuous stroke diagrams taken from a double-acting steam engine. The

done against the piston during the forward stroke. Similarly the areas H K C N and K D L represent the work done on and against the piston during the backward stroke. The net work done during each stroke is, therefore, represented by the algebraic sum of the positive and negative areas. The most convenient method of finding this net area is by means of the planimeter, which should be used in the usual way, tracing round the diagram thus:—A B C N B G A for the forward stroke, and N H K L D K C N for the backward stroke. The areas so found, divided by the lengths 1-2, 2-3, respectively, and multiplied by the scale of the indicator spring, give the mean effective pressures acting on the piston during these two strokes. The mean of these two mean effective pressures is, of course, the average mean effective pressure for one revolution, and would correspond with the average mean effective pressure found from two ordinary indicator diagrams taken simultaneously from both ends of a cylinder.

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The Platform Ticket System.

A CORRESPONDENT at Ealing, writing to the Editor with reference to the paragraph on this subject published in the last issue of the RAILWAY MAGAZINE, says:—"Why are you 'glad to learn that the Great Western Company are extending the platform ticket system'? It appears to me to be a hardship on the public, having to pay to go on to the platforms to see friends off, and no doubt is much resented. Even at many London stations where there is a barrier, permission is usually given to accompany friends to the platforms. The fact of being able to walk on to the platform and look at the trains, etc., creates in many people an interest in railways, which I should have thought you would be glad of, considering that the RAILWAY MAGAZINE exists by the support of that portion of the public which is interested in Railway matters." In reply to this friendly criticism, it must be pointed out that several of the largest railway companies in this country are experimenting with the platform ticket system at stations which are regarded as suitable for the purpose. The primary object in view is to improve the train working by eliminating stops for ticket collecting purposes, and by keeping the platforms as clear as possible of persons who do not intend to travel by train. But, as far as the public are concerned, other advantages may be claimed for the system, which, in view of the acknowledged success attending its adoption, will no doubt ultimately be extended to many of the principal railway stations in the United Kingdom. The innovation has, indeed, been regarded as of sufficient importance to warrant the introduction of electric automatic machines, from which, on the payment of one penny, any person may obtain admission to a platform. Baron Nettelbladt, the managing director of the British Company now making these machines, has taken the trouble to write a book, with a view to make the public in this country acquainted with the many advantages that may be expected to accrue from a plan which has for many years been followed on the Continent with most satisfactory results. Baron Nettelbladt very truly asserts that the "present custom of permitting platforms to be a happy hunting ground for luggage thieves, pickpockets and loafers is, in reality, an outrage on the rights of the railway companies and the safety of passengers." Comparatively few people have raised any serious objection to the introduction of platform tickets, and the suggestion that the charge levied is virtually a "poll-tax" cannot be regarded as serious, in view of the fact that every person who produces a passenger ticket is *ipso facto* free to enter any platform. The necessity for "closed" stations has increased with the growth of traffic, and experience has already proved that a penny toll is sufficient as a rule to keep out loiterers and undesirables of every character. Nothing has yet been said as to the additional source of revenue that platform tickets will represent to a railway company, but it may be mentioned that in Prussia the State derives from this source a sum annually averaging £350,000. The same system obtains in Australia and in South Africa; but in each case, a charge of threepence is made to non-ticket holders, while in New York a "platform" ticket must be taken to the station at which a certain train is next to stop, even though the place be fifty miles distant!

* * *

The New Terminus at Waterloo.

THE last internal relics of the original terminus of the London and South Western Railway at Waterloo have disappeared with the pulling down of the long range of buildings wherein the whole of the administrative offices were formerly grouped, and where in more recent years the work of the Traffic Department alone was conducted. A strange transformation was disclosed in the first week of April this year, when temporary wooden passage ways connecting the old and new parts of the station were removed, enabling the public to realise more fully than before the vast improvement which the company are effecting. Trains were loading and discharging at five of the long and wide modern platforms, with their lifts and separate subways for passengers and luggage. Rails and buffer stops at Platform No. 6 were in position, almost ready for use, and the foundation work of No. 7 platform was advanced sufficiently to suggest that it will be opened in the course of a month or two. Overhead,

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the contractors were rapidly carrying the new glass and iron roof further in the direction of York Road. A few trains were still being despatched from the old No. 6 platform, but the bulk of both main line and suburban traffic was being dealt with elsewhere. Standing out boldly in the old Central Station is the new Administrative block in which handsome dining, tea and refreshment rooms are to be opened at the end of the present month. The early buildings still left standing included the main line buffet, and a more remarkable contrast it would have been difficult to conceive. Here it was possible for about 30 people to dine at one time, and as many more could be accommodated in the North Station; but the new dining room will seat comfortably more than 120 persons; and it will be possible to have meals *a la carte*, or an excellent *table d'hote* dinner at 3s. 6d. Brilliantly lighted and well ventilated, this hall, Jacobean in its decoration, can be entered from an electric lift, which will also be used by visitors to the adjoining tea room, where the ordinary menu will be supplemented by seasonable delicacies of various kinds. The new refreshment buffet is underneath on the ground floor, and there, as throughout the rest of the establishment, it is evidently the determination of the caterers, Messrs. Spiers & Pond, Limited, to do all that is possible to win the appreciation of the public.

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London and North Western Railway Publicity Department.

We are officially informed that the letting of sites for factories and new works on land adjacent to the London and North Western Railway is now undertaken by the Publicity Department at Euston. At many places factories are already available, and, as is well known, the London and North Western Railway serves, or is in direct communication with, all the important manufacturing towns, ports, and coal centres of the United Kingdom, affording unrivalled facilities for the rapid transmission of merchandise. Manufacturers and others interested in developing new industries should therefore communicate with Mr. A. Feiron, Publicity Department, Euston Station, N.W. Full particulars as regards available sites and siding possibilities to various centres will at once be forwarded, with any further information that may be desired. Since Mr. Feiron was appointed as Chief of that department in 1909, many new developments have been witnessed. In addition to taking over the North London Railway advertising, special attention has been devoted to the famous holiday centres served by the Company, with the result that the traffic has largely increased. Advertising boards have been inaugurated in North and Central Wales and the Lake District; new methods followed in newspaper advertising; large hoarding spaces taken in all the principal towns, where attractive posters are now displayed; and the character of the various guides and other publications has been much improved. Simultaneously, the advertising possibilities of the Company's numerous carts, vans, and other road vehicles have been realised, and now many of these vehicles have been turned into "moving hoardings" without impairing their working efficiency. Striking success has also attended the issue of official postcards, which not only advertise the principal tourist resorts, but show the progress of the railway from the early "thirties" to the present day. Nearly 11,000,000 of these cards have already been sold, and they are still in continuous demand. Mr. Feiron may be heartily congratulated upon this splendid record of work, which has, in our opinion, done as much as anything else to raise the earnings of the Company to their present unrivalled level.

* * *

Railway Bills in the House of Commons.

The recent defeat of the Fishguard and Rosslare Railways and Harbours Bill in the House of Commons affords a striking illustration of the methods which have in late years there, been pursued towards Railway Bills. Time after time when a Bill has been presented to effect some small purpose in connection with a particular company, the Second Reading debate in the House of Commons has resolved itself into a discussion of matters having no relation whatever with the measure itself, but arising from some grievance that would in a court of law be held to be wholly foreign to the issue to be tried. But the latest illustration of this singular procedure goes even beyond that point. The Fishguard and Rosslare Company promoted a scheme having for its object the development and improvement of Rosslare Harbour. In the preamble was recited authority for the Great Western Company (of England) and the Great Southern and Western Company (of Ireland) to guarantee capital and to subscribe towards the outlay. The merits were, therefore, simple and clear, but a glance at the report of the debate, while revealing no criticism whatever upon the real object of the measure, brings out a variety of complaints on other and what certainly appear on such an occasion to be largely, if not wholly, extraneous topics. These subjects ranged from the question of competitive examination for clerkships on the Great Southern and Western Railway to the diversion of traffic from Dublin to Waterford and some of the southern counties of Ireland, while the last Irish railway strike also loomed large in many of the speeches. These complaints were,

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in fact, directed solely against the Great Southern and Western Company, and, whatever might be the foundation for the allegations heard, they seemed to have nothing whatever to do with the question as to whether certain repairs and improvements should be effected at Rosslare. One hon. member bluntly put the position in a nutshell when he said "If directors are ever going to have a sharp lesson from the House, I believe that such a very well-deserved occasion now presents itself." Thus the Fishguard and Rosslare Company were beaten with the Great Southern and Western stick—not for anything alleged against the promoting company, but apparently in punishment for an accumulation of complaints against the Irish Company. It is true that the Speaker ruled the question of competitive examination for clerkships out of order, but behind the majority of the speeches this complaint occupied a place not less prominent than it held during protracted discussion in Ireland. The only consolation is that possibly the defeat of the Bill may bring to a head the question of the legitimacy of what may be called "omnibus" complaints against measures which are limited to the execution of some definite and urgent work.

* * *

Euston Station.

IMMENSE public advantage will accrue from the extensive alterations which the London and North Western Company are carrying out at Euston. Since the great terminus was opened, the conditions of railway traffic have undergone complete revolution, and demands for further accommodation are still increasing. Among these none will be more remarkable perhaps than that only just beginning to manifest itself in connection with suburban services. The time is, therefore, peculiarly opportune for the grouping of the booking offices and various rooms to which travellers have access. For this purpose a considerable portion of the existing courtyard is being utilised, so as to bring the station more into harmony with the more modern termini of the Metropolis. We hope to be able to publish a full description of this important work as it approaches completion. Meantime, congratulations may be offered to the directors upon this further illustration of the enterprise which has ever characterised the London and North Western Company.

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National Union of Railwaymen.

A DRAMATIC birth was given to the new organisation of labour which, under the title of the National Union of Railwaymen, takes the place of three kindred bodies heretofore enjoying separate existence—the Amalgamated Society of Railway Servants, the General Railway Workers' Union, and the United Pointsmen's and Signalmen's Society. Representatives of these combinations met formally to record the disappearance of the old and the advent of the new. They did so by lowering the lights of the hall in which they gathered together, and afterwards restoring the illumination when the banner of the latest league had been stretched across the platform. The new organisation enters upon its career with nearly 180,000 members—forming the largest trade union in the country—and there can be little doubt that its ranks will grow. Such a body must undoubtedly wield great power, and, in the interest of labour not less than in that of capital, we fervently hope that its influence may ever be exercised for the common good.

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The New Canadian Pacific Steamship "Empress of Asia."

THE Canadian Pacific Railway steamer "Empress of Asia" will, on Saturday, June 14, leave Liverpool on her initial voyage *viâ* South Africa to Japan and China. Representing another magnificent addition to the fleet of this enterprising company, the new vessel—destined for the Vancouver-Yokohama-Hong Kong service of the Canadian Pacific Railway—will make a preliminary cruise to South Africa before proceeding to the harbours of the Pacific. This is only fitting when it is remembered that the Canadian Pacific has come to be the great Imperial highway, and there is little doubt that many citizens of the Dominion will gladly avail themselves of this opportunity to pay a visit in a Canadian steamer to their cousins of the Union. South Africans, too, will welcome the chance of travelling to Cape Town and Durban on so splendid a vessel, of 16,850 tons and 21 knots speed. The majority of her passengers will make this cruise part of a journey round the world, joining the rail lines of the Canadian Pacific at Vancouver, travelling through the Rockies, over the prairies across the Continent to Quebec, and completing the circle of the globe on an "Empress" liner of the Canadian Pacific Atlantic service. Good taste and comfort are the keynotes of the fittings of the "Empress of Asia." The decorations have been designed for the most part in the styles prevailing between the periods of James I. and George II. In white wood of a very simple character, the dining saloon is a Georgian room, its main feature being a very fine wrought-iron balustrade round the gallery. The writing room is a simple grey panelled room of about the period of George II. with mantelpiece and furniture in the Chippendale style. In the Jacobean style, the large smoking room is panelled in oak, with carved pillars and pilasters. At one end is a handsome carved mantelpiece of somewhat similar design to a celebrated one in the South Kensington Museum, and at the opposite end is a large bow window designed on the lines of the famous front of Sir Paul Pindar's house in the same museum. The lounge is a noble room in the William and Mary style, reminiscent of the splendid apartments decorated by Sir Christopher Wren at Hampton Court Palace for those

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monarchs. Features of the rooms are the paintings over the doors, two of these being by Mr. C. Maresco Pearce, one of the most promising English artists of the day, while two opposite and a painting over the mirror are by Mr. Chown, one of the best known artists of the Chelsea School. Leading out of the lounge is the Verandah Café, in old English half-timber work. Full particulars respecting the voyage and the various shore excursions arranged may be obtained from the London Offices of the Company, 62, Charing Cross, S.W., and 67, King William Street, E.C.

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What Our Railways Earn in Twelve Months.

In many respects the *Railway Year Book* is a unique publication, and contains much information that is not otherwise available in collected form. Not the least valuable of its special features are the tables of railway earnings and expenditure and the number of passengers conveyed. These are prepared on a basis different from the Board of Trade Returns, and more up-to-date, seeing that the 1913 volume includes statistics for 1912, whereas in the Government returns only figures applying to 1911 are yet published. In the *Railway Year Book* a table is included setting forth the net earnings exceeding £100,000 per annum. There are 13 companies which realise more than £1,000,000 after expenditure has been deducted from gross receipts. Three exceed £5,000,000, the London and North Western taking the lead, followed by the Great Western, while the Midland goes over the limit specified to the extent of £41,159. The North Eastern comes next with £3,875,160, and five companies earn between £2,000,000 and £3,000,000. Three of these are in England—the Lancashire and Yorkshire, Great Northern and Great Eastern—and two, the North British and Caledonian, in Scotland. The remaining "£1,000,000 lines" are the London and South Western, South Eastern and Chatham, Great Central and London, Brighton and South Coast. There is then a big drop in the English and Welsh list to the London Electric Railway, with £446,856 to its credit; but the gap is filled in Scotland by the Glasgow and South Western (£845,271), and in Ireland by the Great Southern and Western (£654,592), though the Great Northern of Ireland is not far below the London Electric, ranking approximately with the Taff Vale, Metropolitan District, Metropolitan, and North Staffordshire, each of which exceeds £400,000 in net earnings. The other lines which realise over £100,000 are the Barry, Cheshire Lines, Hull and Barnsley, Great North of Scotland, Furness, Midland Great Western of Ireland, Highland, North London, Cardiff, Rhymney, Central London, Northern Counties Committee, Cambrian, and Dublin and South Eastern. The Scottish year is reckoned to July 31, 1912, but in the latest volume of the *Railway Year Book* particulars are also given of the Scottish earnings for the five months ending December 31, 1912.

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Passenger Traffic Statistics.

Another useful table included in the *Railway Year Book* gives the number of passengers conveyed on each railway in the United Kingdom during the last 12 months where the total exceeds 10,000,000, excluding season ticket holders. Some illuminating details are given, but it should be pointed out that the statistics take no account of the length of journey. For example, while on the London Underground and other lines there are millions of penny fares, on the great trunk lines such journeys are relatively very few. In 1912 the Great Eastern heads the list with a total of nearly 100,000,000 passenger journeys, but for third-class travel the Great Western, second as regards the gross total, takes precedence by over 1,000,000. Third place is at present held by the London Electric, with only one class, its figures exceeding both the Great Eastern and the Great Western third-class totals. The London and North Western comes next with 79,000,000 travellers, followed by the Metropolitan, Metropolitan District, Lancashire and Yorkshire, London and South Western, North Eastern, London, Brighton and South Coast, and South Eastern and Chatham, each carrying between 50,000,000 and 80,000,000 passengers. The Midland Company follows with 44,000,000, and succeeding figures relate to the Caledonian, North British, Great Northern, Central London, and North London. The remaining companies enumerated in this table are the City and South London, Great Central, Glasgow and South Western, Glasgow District Subway, Great Northern and City, Liverpool Overhead, and Cheshire Lines Committee. It will be noticed that in the returns all the London tube and underground lines are included except the Waterloo and City, which forms part of the London and South Western total. The Glasgow District Subway, the Liverpool Overhead, and the North London are added. For first-class travel the Metropolitan, Metropolitan District, and Caledonian are the only companies which have more than 2,000,000 passengers, being followed by the London and South Western, North London, London, Brighton and South Coast, Great Western, North British, Great Eastern, South Eastern and Chatham, London and North Western, Lancashire and Yorkshire, Liverpool Overhead, and North Eastern. As regards second-class travel, the question is too much involved by recent changes to admit of authoritative comparison, but it may be noted that the South Eastern and Chatham easily takes first place in this respect with 3,430,706 second-class passengers in 1912, followed by the North London, London and South Western, and Great Eastern, each with a smaller number.

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British Railways in the Dominican Republic.

In the Dominican Republic, the oldest European settlement in America, the Samana-Santiago line, running from Sanchez to La Vega—a distance of 73 miles—is locally known as the "Scotch Railway," because it belongs to the Baird family, of Glasgow. Although there are two branches—one running from a place named after the owners to San Francisco de Macoris, and the other from Las Cabullas to Salcedo—the main track has not yet been extended to Santiago. It is understood, however, that the Government propose to supply the missing link by building two new lines—one from Moca to Salcedo, the other from Santiago to La Vega, thereby establishing through communication from Sanchez to Puerto

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Plata. Another railway from Santo Domingo city, the capital, to the Samana-Santiago line at Baird or La Vega is also contemplated. Sugar is the principal article of export, but, although the soil in the neighbourhood is by experts regarded as ideal for tobacco growing, the methods at present adopted by the cultivating owners are somewhat antiquated. This is clearly proved by the prices realised. Dried leaf here does not realise more than 3 dollars, or 4 dollars per 100 lbs., but the plantation growths of Porto Rico bring from 90 dollars to 110 dollars for the same weight. While British enterprise is seen in the railway communications, the Union Jack is unfortunately conspicuous by its absence in all the ports of the Republic. The Hamburg-American Line runs two steamers a month between Hamburg and these ports, but a direct line from the United Kingdom is much needed. There are openings for the investment of British capital in the interior, where cocoa, sugar cane, coffee and cotton are profitably cultivated; but Americans and Germans are apparently much more alive than our own people to its inherent possibilities, and in the circumstances the expansion of British trade is seriously hampered.

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Load Pulling in America.

DIFFERENCES in conditions render such achievements as the haulage of 100-wagon goods trains on the Great Western and Great Northern Railways performances which are in this country possible only in particular cases; but in America it is the practice, where circumstances are favourable, to utilise engine haulage capabilities to an extreme degree. The Chesapeake and Ohio Railway, a line already utilising 4–8–2 ("Mountain" type) locomotives in passenger service, has developed the 2–8–2 ("Mikado" type) for heavy freight traffic. In this class the latest engines are designed to haul 4,000 tons over a long 0·3 per cent. grade at a sustained speed of 15 miles per hour, and to have a margin of power to provide for adverse conditions. One has hauled an 87 car train of 5,889 tons up an 8-mile continuous 0·2 per cent. grade at an average speed of 16 miles per hour. These locomotives have cylinders 29 in. by 28 in., 4 ft. 8 in. coupled wheels, 170 lbs. of steam, 8,934 sq. ft. of heating surface (including a Schmidt superheater), 66·7 sq. ft. of grate area and weigh, without tender, 140 English tons. One of these locomotives has pulled a train of 112 cars of coal, weighing 7,590 tons, over a division with an 8-mile ruling grade of 0·2 per cent. at an average speed of 15·5 miles per hour, taking the hill at a speed of 9·5 miles per hour. A particularly noteworthy performance was recorded at mile post 44½, when, after stopping for water at the top of a 0·2 per cent. grade, the locomotive started this 7,590-ton train with the greater proportion of the train on the grade. For the last 4 miles before making this stop, the locomotive developed a sustained drawbar pull of 57,750 lbs. at a uniform speed of 6½ miles per hour, which means that it maintained a tractive power of 1,000 lbs. in excess of its maximum rated power based on 85 per cent. of the boiler pressure of 175 lbs., at which point the gauge registered. It has developed 2,376 drawbar horse power, or one drawbar horse power for every 132 lbs. weight of locomotive. It should be remembered that, except where specially noted, American tons of 2,000 lbs. are represented, but even with this qualification the results realised are remarkable.

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A Train which arrived Seven Years Late!

A STORY comes from America recording the arrival of a train which reached its destination more than seven years behind time on a part of the Gulf and Interstate Railway, now included in the Atchison, Topeka and Santa Fé system. The train started from Beaumont, Texas, bound for Port Bolivar at 11.30 a.m. on September 8, 1900. The distance is 71 miles, and the train was due in Port Bolivar at 1.55 p.m. It maintained its schedule for the first 33 miles to High Island. There it was surrounded by waters from the Gulf of Mexico, which had crept more than 38 miles inland, and flooded the railway. When the waters subsided, the train was high and dry on the prairie, the only rails left being those on which it stood. For miles up and down the line not a vestige of track remained. After hours of terror the passengers made their escape through the mud. The engine and four cars were abandoned, and remained a landmark. Eventually the affairs of the Gulf and Interstate revived. The road was re-built, and at last the rails from either end were connected with those under the long overdue train. At first it was proposed to tow the weather-beaten equipment to its original destination. The machinists looked over the rusty locomotive, and found it in good condition, considering its exposure to the elements. They worked on her for a while, and pronounced her fit to complete her journey. Removing the seaweed in her rusty firebox, and raking away the *débris* round the wheels, they fired her up, and amid the cheers of every one, she moved off, creaking and "rheumatic" in her joints, but still serviceable. The news was telegraphed to Port Bolivar, and when the train, more than seven years late, arrived, the time of her reappearance and length of delay were gravely chalked on the bulletin board. Half-a-dozen of the original passengers assembled to greet the train, and the fact that it had actually reached its destination was telegraphed all over the country.

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Isle of Wight Central Railway.

WHEN the larger railway companies are showing such heavy increases in their traffic receipts we are glad to note that the Isle of Wight Central Company are also able to report an advance of several hundred pounds week by week in earnings. This very satisfactory result is being achieved notwithstanding that a substantial loss of revenue, due to a sweeping reduction in local passenger fares, is being made good. Should such progress continue, there seems to be every prospect of the dividend, which, for the first time in the history of the railway, was paid last year, being at least continued, if not actually increased.

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Railwaymen and "Quarrelsome Wives."

A FEW months ago discussion arose as to how far a railway company is entitled to concern itself with the affairs of its employés when off duty. The New York, New Haven and Hartford Railway Company has taken a very decided step

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in the matter by officially directing their employès not to quarrel with their wives! The men are warned that the company regard the family man as more desirable than the single man, who lacks ties and stability. It is added that the wives also will be watched, and those who dissipate their husbands' earnings and get on the black list for not paying their bills will involve their husbands in trouble. The staid married man, linked to a wife of industrious habits, will be selected for promotion, in preference to men of sporting inclinations or men whose wives show adverse traits. Several employés have been told that unless they have less trouble at home, they cannot be regarded as safe to handle trains. Some justification for this unusual notification is, no doubt, found in the fact that a recent accident on the New Haven Railroad was caused by the carelessness of an engineer after a quarrel with his wife.

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"Strathcona's Slush."

THE father of an officer in the Locomotive Department of the Canadian Pacific Railway, sends us the following, recently received from his son:—"When Lord Strathcona was called upon to drive the golden spike into the last sleeper of the Canadian Pacific Railway, the foreman in charge of the section was told to make a hole in the sleeper, so that the precious spike could easily be extracted and preserved under a glass case. As it was early spring, with a thaw setting in, the foreman bored out quite a substantial hole, and, to make the ceremony of 'driving the spike' appear real, he carefully made the deep hole and filled it with slush. When Lord Strathcona, bending low before a distinguished gathering, raised the mallet and drove the huge nail far into the sleeper, a great squirt of melted snow instantly darted back at him, covering his long beard and immaculate clothes in the most unexpected and embarrassing manner. But his Lordship did not forget to join in the chorus of half-smothered merriment that burst forth at his expense."

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Passes for the Silent Partner.

WE have to thank a Canadian correspondent for the following communication:—"Two ideas in the safety crusade of the railways of the North American Continent—now assuming national proportions—are not without human interest. The San Francisco system, which embraces the Southern Pacific Railway Company, has made a direct bid for the co-operation of 'the silent partner' by announcing that it will give passes, good for six months, to the wives, mothers or sisters of the men employed on the division which makes the best record in the reduction of personal injury accidents for the year just ended. The Minneapolis, St. Paul and Saulte Sainte Marie Railway Company, familiarly known as the Soo, has posted a notice in its shops at Fond de Lac, Winconsin, forbidding the wearing of neckties or torn overalls by its workmen. Shop records in the past show that both the ties and the tatters have resulted in many serious accidents."

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Modern Railway Working.

VOLUME III. of this serial publication of the Gresham Publishing Company, Limited, now available, well maintains the high standard established by the first and second volumes. Included are articles on railway bridges, the design and construction of railway steel work, tunnel construction with shields and compressed air, re-inforced concrete in railway construction, and permanent way. The plates show the Findhorn Viaduct, Highland Railway; bridges over the Severn at Worcester (Great Western Railway); King Edward VII. bridge at Newcastle (North Eastern Railway); Greathead shields at work in the tunnels of the Central London Railway; reinforced concrete viaduct over the River Suir at Waterford; and a reinforced concrete jetty for the Alexandra (Newport and South Wales) Docks and Railway. There are numerous other illustrations and drawings, and the text is full of valuable and practical information.

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The Royal Visit to Crewe.

The Crewe Souvenir (April) issue of the RAILWAY MAGAZINE contained the first complete description which has been published of the London and North Western Railway Company's Locomotive Works as they now exist, and the number was immediately in such great demand that the edition was soon out of stock. Arrangements have, however, been made whereby further applications for copies can to a limited extent be met. A special programme was prepared for the recent visit of the King and Queen, and their Majesties were deeply impressed by the inspection which they made of the principal parts of the establishment, where they witnessed the process of engine building in its various stages.

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Two very gratifying presentations were made to Mr. Henry Currington upon his retirement from active work as rolling stock controller of the Great Central Railway, in which capacity he had served for 40 years. The first tribute came from Mr. Currington's own staff, and took the shape of a marble timepiece, a case of fish-eaters, and a photograph of the staff. Later the same day a still more striking compliment was paid by the traders of Sheffield and the Great Central Staff as a whole. The appreciation in which Mr. Currington was held was then made manifest by the attendance of all the chief officers of the company, and the General Manager, in eloquent words, bore testimony to that gentleman's work, which was so valuable that the directors wished to retain his services in a consultative capacity. Sir Sam Fay, acknowledging a very cordial personal reception, seized the opportunity to show how much he has at heart the welfare of the humblest among railway workers. He said that the men who had the roughest work to do always had his sympathy, even if they did not get all they wanted. There was a good deal of need in these days for sympathy for the men who did the roughest work, and if there was a little more sympathy there would be less trouble. During the last ten years the Great Central had had a more strenuous time than any other company. They had always been growing very fast, but had never been able to get on the "top of the job," although they had spent millions. With the exception of the first year of his service, the company had spent on an average a million a year, and they were not on the top of the job yet. He had thought sometimes that they were pretty nearly there. Then they had had a boom in trade, and it had made their goal more distant. But they must not grumble. The travelling public and the traders might rest assured that whatever the directors and officers could do towards giving them the services to which their traffic entitled them, and the help that they so thoroughly deserved, would be given.

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We have received an official copy of the staff regulations issued by the Governor-General for observance in connection with the South African Railways and Harbours. Except where otherwise specifically provided, these rules repeal all those made by the late Cape and Natal Governments. No person is, without the approval of the General Manager, eligible for permanent employment as an officer unless he is (*a*) over fifteen and under forty-five years of age; (*b*) free from physical or mental defect or disease and able to pass the prescribed medical examination; (*c*) of good character and temperate habits; (*d*) a British subject. Any exception made by the General Manager under this regulation has to be reported to the Railway Board. A definite educational standard is laid down for candidates under and over 21 years; and every officer supplied with uniform must, when on duty, appear in it neat and clean, with the badges properly exhibited. Courtesy to the public is enjoined in the next regulation, which says: "The conduct of officers must be prompt, civil, and obliging. They must afford every proper facility for business to be performed; be careful to give correct information, and when asked give their names without hesitation." No officer is allowed to smoke during the ordinary hours of duty while on the premises of the Administration, and all are invited to communicate freely with their superiors "as to anything that may tend to promote the interests of the service, or conduce to safe working." Any officer who considers that he has a grievance or that he is suffering under any disability, and who desires to seek redress or to make any representation in regard thereto, must first approach his superior officer, and if he be dissatisfied with any decision given by such superior officer, he may appeal in writing through his superior officer to the head of his department, and thereafter, if necessary, by letter addressed direct to the General Manager. If he be not satisfied with the decision of the General Manager, he may within thirty days appeal to the Railway Board, whose decision is final. The superannuation regulations under the Railways and Harbour Service Act, 1912, are issued in a separate book.

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Mr. J. H. Vickery, the new General Manager of the Alexandra (Newport and South Wales) Docks and Railway Company, has received a handsome ormulu clock from the Board of Management and staff of the London and South Western Railway Servants' Orphanage, "in sincere appreciation of his many sterling qualities and of his devoted and invaluable services as honorary secretary of this Institution during the past 12 years." In making the presentation in the dining hall of the institution at Woking, where all the inmates were assembled, Mr. Douglas Eve, the Chairman of the Board, said: "We are here this evening to say *au revoir*, and not 'farewell,' to our respected and beloved honorary secretary, because we hope to have the pleasure of seeing Mr. Vickery a great many times. The Board of Management deeply feel the loss of his services to this Institution, apart from his own genial way of transacting business. I myself regret very much Mr. Vickery's departure. It is to his advantage to go to South Wales, and we wish him God-speed, sincerely hoping that he may be successful in his undertaking." Mr. H. G. Warne, the secretary, endorsing the Chairman's remarks, said he had known Mr. Vickery 36 years, and gladly testified to the excellent services he had rendered the Orphanage. Mr. Vickery, in reply, said: "I well remember that when your former chairman (Mr. Higgs) approached me some years ago to ask me to take the hon. secretaryship, I inquired, 'What about the work,' and was told 'it is not much—only a few cheques to sign, that's all.' —I found it was a little more than that. But I would not like to be connected with an Institution without knowing that everything was going on all right, and I made a point of attending the meetings whenever I possibly could. I hardly know how to thank you all for the present you have given me. I am very grateful for it, and it will serve me as a constant reminder of my connection with the Orphanage and all you good children. It will always be enshrined in my heart, and I shall hope to be connected with the Institution as long as I live. It was a matter of great consideration to me before I accepted my new post, and it came to me in a very gratifying way. It was not personally sought. I took it as a great compliment to have been offered the post, and I accepted it, and one source of gratification is that I feel I am going down there with the best wishes of everyone connected with the South Western Railway. I hope that this Institution will go on and prosper, and that in years to come the Orphanage will be free from any financial embarrassment whatever."

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A steamship service in which the Midland and Metropolitan Railway Companies are much interested is shortly to be inaugurated between Tilbury and Ostend. For the sea journey three new steamers are being constructed—two by Messrs. John Brown & Co., Limited, and one by Palmer's Shipbuilding and Iron Co., Limited. Of 4,200 gross tonnage—or much more than double that of the present Dover-Ostend boats—all are to be driven by turbine machinery, and their principal feature will be the provision of a separate cabin for every passenger. For this purpose two rows of cabins are to be erected on the main and upper decks, forming structures which will extend almost from stem to stern. There will, in addition, be a series of *suites de luxe*, furnished in elaborate style, while the public apartments—dining, drawing and smoking rooms—are designed to afford excellent accommodation to a large number of travellers. It is, indeed, the determination of the owners—a syndicate headed by Lord Aberconway, the chairman of the Metropolitan Railway—that the new vessels shall be veritable floating hotels, comparing favourably with the finest of those engaged in the Transatlantic trade. All three steamships are now being completed as rapidly as possible, the desire being to begin the sailings next month (June). The Midland Company have arranged to run special trains from the North of England direct to Tilbury, while on the Metropolitan and Metropolitan District Railways other trains will travel thither *viâ* Barking from all Underground stations. Thus a very extensive traffic may from the outset be anticipated, especially as the through fares will be considerably lower than those *viâ* Dover. Although owners of the magnificent steamers on that route, the Belgian State Administration are giving cordial welcome to the Tilbury scheme, having long been anxious to secure such an additional feeder to the State Railways of Belgium. The vessels which are to run from the Thames will be by far the largest ever engaged in the cross-Channel services.

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The appointment of Mr. E. A. Neale as General Manager of the Great Southern and Western Railway—the most important railway position in Ireland—was made the occasion of a dinner given in his honour by old friends and colleagues in the railway and steamship companies. A large and representative gathering, embracing all the principal officials of the railway and steamship interests of the country, afforded proof, not alone of Mr. Neale's popularity, but of the satisfaction among his confrères which the appointment has given. The chair was occupied by Mr. John Coghlan, Traffic Manager, Dublin and South Eastern Railway, who said all present agreed that Mr. Neale was most capable and fit to adorn the position he had been called upon to occupy. Their guest and himself started their railway career together as boys in the Irish Railway Clearing House. They had fought many a hard battle in the interests of their respective Companies, but Mr. Neale had never taken an unfair advantage of anyone, and always been found a straightforward, upright honest man. He believed him to be one of the greatest railway authorities of the present time. They all knew his experiences before Railway Commissions, Arbitration and other Courts of Law, and could truthfully say that in any of these contests he had always proved himself "top dog." When his promotion was first announced, a wave of delight was felt in the whole railway world. They were confident that Mr. Neale would give every satisfaction in his new position, and they wished him long life, health and prosperity. Mr. J. R. Kerr, General Manager, Cork, Bandon, and South Coast Railway, and Chairman of the Irish Managers' Conference for the present year, and Mr. Walter Baird (Laird Line, Limited), on behalf of the Steam Packet Companies, joined in the tribute. Mr. Neale acknowledged the high compliment paid to him by such a representative gathering, and remarked that to few men was it

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given in this life to attain the goal of their ambition. He had been fortunate in getting to the position he now occupied. Some little share of it might be merit, but all through his life he had been fortunate and happy in his work, lucky in his play—as those who had seen him at golf could testify—but most fortunate of all in his friends. The toast of "The Chairman" was proposed by Mr. Charles Smith, Secretary, Irish Railway Clearing House.

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MR. F. HARTNELL has retired from the position of Chief Accountant on the London and South Western Railway, after receiving from the officers and staff a presentation consisting of a canteen of cutlery and table silver. This handsome gift was made on behalf of the subscribers by Mr. H. A. Walker, the General Manager, who, voicing in happy phrase the sentiments of all, reminded them that when Mr. Hartnell entered the Company's service 28 years ago, the capital stood at about £30,000,000, while now, at his well-earned retirement, that figure had increased to over £50,000,000. "Notwithstanding that great expansion of capital, he is leaving us," continued Mr. Walker, "with accounts for the past few years showing better results than 28 years before, when he first came among us, and we congratulate him. Week after week, month after month, year in and year out, he has been as it were with his hand on the pulse of this living mass of capital, piecing together the details of the expenditure and revenue received not only from the various departments, but from all the other railways, co-ordinating the figures, and turning out results which, to say the least, must have been most pleasing to the shareholders. How it has been done on some occasions probably only he knows, and I am afraid he will not let us into the secret. But now he has said 'You must let me go,' and we are assembled to say good-bye; but we want to add that he will oblige us very much by taking away with him this little case, into which we have packed a lot of goodwill and a few knives, forks, and spoons. Mr. Hartnell, your comrades and staff in saving good-bye desire your acceptance of this trifling symbol of their good wishes for your restoration to health, and the prolongation of your days in peace and happiness." Mr. Hartnell, responding to these generous words, mentioned that he was ceasing active work after 50 years of railway service, of which the last 28 years have been devoted to the London and South Western Company, and another ten years partially so while in the service of the Somerset and Dorset Joint Committee. He had served under five Chairmen and four General Managers, but none of the Directors or Chief Officers in office on his arrival at Waterloo now remained, so that he might be considered the last of the "Old Guard." He expressed his appreciation of the sympathetic consideration extended to him by the present Chairman and Directors and all the officers and staff on his recent breakdown in health, and thanked Mr. Walker for his courtesy and kindness during their short business intercourse, which had been of the most agreeable and amicable description.

* * *

THE marvellous development of the railway and all that pertains thereto since its inception less than a hundred years ago is one of the greatest testimonies to the ingenuity of the human intellect. "The Iron Road" has conquered the universe. No impediments seem insurmountable to the fertile brain of the railway engineer. If steam is impossible, he invokes the aid of electricity: if he cannot lay his own iron-track on terra firma, he suspends his trains on aerial cables. The wildest effort of Nature has for him no terrors. Messrs. Cassell announce what promises to be a most fascinating epitome of the achievements of man in his efforts to conquer Nature. "Railway Wonders of the World," which is the title of a new serial to be issued in fortnightly parts, will be edited by Mr. F. A. Talbot, and will tell the story of the universal railway conquests, including undertakings such as "Across the Andes by Aerial Railway," "Crack Trains of the World," "Railroading the Glaciers," "The Uganda Railway," "The Wonders of Signalling," "Spending Millions to Save Minutes," "The Story of the C.P.R.," "Monster Engines," "Electric Giants." The serial will be illustrated with 24 coloured plates and a magnificent series of photographs such as never before has been available in one work.

* * *

As an erroneous impression has been created by our correspondent "Voyageur," in his second article on "Modern British Restaurant Car Services," we desire to state that the Pullman Company Limited carry out their own catering arrangements on the Continental express trains in the South Eastern and Chatham Railway London-Dover and London-Folkestone services. Breakfasts, luncheons and suppers are served at an inclusive charge of 3s. per head, and passengers have an excellent wine list for selection. Eau de Cologne is also sold in the beautifully appointed Pullman cars, which have added enormously to the popularity of these services.

* * *

AN important addition to the Continental traffic facilities of the South Eastern and Chatham and Northern of France Railways is announced. Additional services (1st and 2nd class) between London and Paris daily (Sundays excepted) will begin on and from July 1 next, and continue until October 31. The itinerary from London will be as follows:—

Charing Cross	dep.	4.30	p.m.	
Dover	arr.	6.0	,,	Restaurant Car between Calais & Paris
	dep.	6.15	,,	
Calais	arr.	7.35	,,	
	dep.	8.5	,,	
Paris	arr.	11.25	,,	

This will be a very convenient service for passengers preferring to pass the night in Paris, so that they may join the day express trains the following morning for destinations beyond. From Paris to London the itinerary will be:—

Paris	dep.	12.30	a.m.
Calais	arr.	6.20	,,
	dep.	6.45	,,
Dover	arr.	8.5	,,
	dep.	8.20	,,
Charing Cross	arr.	10.15	,,

First class sleeping cars from Paris to Calais. Passengers will be allowed to enter the sleeping cars at the Gare du Nord, Paris, at any

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time after 11 p.m. These additional services will not run on Sundays. Therefore passengers arriving in Paris on Saturday evening from Italy, the Riviera and other places will not find a connection from the Gare du Nord, Paris to London until 8.25 a.m. on Sundays (*viâ* Boulogne-Folkestone) or (*viâ* Calais–Dover) until 9.55 a.m. In order that sleep may be obtained, the train in the latter service will not be stopped more than once *en route*, and will run at a moderate speed from Paris to Calais. The Channel crossing will be made in daylight by a turbine steamer, and a first-class Pullman breakfast car will be provided on the train Dover to London. At present passengers from Italy, the Riviera, Switzerland, Aix-les-Bains and other resorts travel from these places to Paris by night, but when the additional 12.30 a.m. service from Paris is running, they will be able to take the day expresses from Italy, the Riviera, Switzerland and Aix-les-Bains, and arrive in Paris during the evening, with a margin of about two hours before the departure of the 12.30 a.m. service for Calais and London, as well as obtain sleeping car accommodation at the supplementary charge from Paris to Calais. The new service from Paris will be a valuable addition for passengers coming to England from Spain and Biarritz by the Sud express. New fast express trains between Calais and Switzerland will run in both directions in connection with the above-mentioned additional services. Wagon-lit and lit-toilette cars will be provided in both directions. From Calais to Switzerland and beyond the service is to run on and from July 1 until and inclusive of September 30, but during October on Tuesdays and Saturdays only; and from Bale to Calais, on and from July 1 until October 31. The connection from Interlaken and Berne will cease after September 15.

* * *

THE Wirral Railway Company have issued a little handbook relating to the popular residential districts served by that line, of which New Brighton is, perhaps, the most widely known. Formed by the Irish Sea, the river Mersey and the estuary of the Dee, the Wirral Peninsula embraces a series of rural areas of distinct Celtic origin, Noctorum, Arrowe, and Landican among the number. New Brighton has reared its modern front upon these ancient holdings, and become one of the merriest of northern marine resorts. The great Birkenhead Docks are there, too, with half a dozen other places all justly receiving the appreciation of residents and holiday makers. Here also is Leasowe Castle, the northern Convalescent Home for Railway Men. Londoners who like variety in their summer programmes might, with advantage, make a journey to the Wirral Peninsula.

* * *

FROM May 1 the Dutch Railways have arranged to run an additional train from Flushing at 7.10 a.m. to Cologne, Frankfort, Hanover, Leipzig and Berlin, in connection with the night service from London. The usual connections are still to be provided, but the additional train will allow of nearly three hours longer in the steamer, thus enabling a rest to be secured before commencing the land journey. From June 1 the 8.35 p.m. Flushing service will leave Victoria at 8.30 p.m. In May the steamer in connection with the 11 a.m. Continental train from Victoria will leave Dover at 12.55 p.m., and Calais at 2.50 p.m., instead of 3.5 p.m., reaching Paris at 6.15 p.m., instead of 6.45 p.m. From July 1 the 2.20 p.m. Continental train from Charing Cross is to start at 3.5 p.m., and be advanced 15 min. throughout to Paris.

* * *

MR. T. W. D. Smith, Chief of the Publicity Department, Great Central Railway, was unable to read a promised paper before the members of the Railway Club on Tuesday, April 8, owing to his absence on the Continent. Mr. G. W. J. Potter therefore dealt with "The Railway Ticket and How to Improve It," in a paper which had been put down for June 10, and on that date Mr. Smith will discuss "The Influence of Railway Publicity." On Tuesday, April 22, Mr. E. J. Miller contributed an illustrated lecture on "The Railways of the Grisons—Switzerland." The May meeting will be held on Thursday, the 22nd, instead of Tuesday, the 13th, so as to avoid the Whitsuntide holidays. Mr. M. D. Greville will then read a paper on "The Glasgow and South Western Railway." On May 26, Mr. H. W. Bardsley has undertaken to deal with "The Problem of Suburban Traffic," and on May 17 a ramble to St. Albans has been arranged.

* * *

A NEW series of 4-4-0 passenger engines of the *George the Fifth* class (Schmidt superheater) is in hand at Crewe, bearing Nos. 82 *Charles Dickens*, 89 *John Mayall*, 132 *S. R. Graves*, 752 *John Hick*, 1138 *William Froude*, 1193 *Edward Tootal*, 2124 *John Rennie*, 2154 *William Siemens*, 2279 *Henry Crosfield*, and 2282 *Richard Arkwright*. These are fitted with the automatic vacuum brake, and have the latest tenders with the brake blocks operating at the back of the wheels. No. 2494 *Perseus* (*George the Fifth* class) is now running without the "Weir" pump and water heater, but it is understood that this will again be fitted, the reason for removing it being to enable a test to be made with and without the arrangement. No. 1628 *Foxhound* (of the same class) has been provided with new large sand boxes placed in front of the driving splashers, and also fitted experimentally with outside lubrication to one of the bogie wheels. There are five "Precursors" at work fitted with Schmidt superheaters, namely, Nos. 7 *Titan*, 513 *Precursor*, 2062 *Sunbeam*, 2164 *Oberon*, and 2166 *Shooting Star*. No. 513 has slide valves, and the remainder piston valves and extended smokeboxes. Nos. 1921 *John o' Gaunt* (late *T. H. Ismay*) and 1971 *Euryalus*, respectively four-cylinder compounds of the *Jubilee* and *Alfred the Great* classes, have been converted to simple, with two inside cylinders 18½ in. by 24 in. diameter. The new 4-cylinder simple engine No. 2222 *Sir Gilbert Claughton* is in regular working after a visit to the paint shop. It is stationed at Crewe, and, as already announced in the RAILWAY MAGAZINE, was employed to draw the King's train on the occasion of his visit to Crewe.

* * *

A GALA and sports meeting in aid of the funds of the London and South Western Railway

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Servants' Orphanage will be held at the Sports Ground, Guildford, on Whit-Monday, May 12. A capital programme has been arranged, concluding with a display of fireworks and illumination of the grounds at night. Cheap tickets will be issued by the London and South Western Railway from stations within 50 miles radius of Guildford at single fare and a third for the return journey (minimum 1s.). The special return fare from Woking will be 8d., tickets being issued on production of admission ticket. Tickets may be purchased at the London and South Western Railway offices, of the railway staff, the committee, or may be obtained from the sports joint hon. secs., T. L. Hilditch, Goods Department, Guildford, and F. W. Tomes, The Croft, Woking.

* * *

A FURTHER series of locomotive trials have been carried out on the Somerset and Dorset Joint Railway. It may be recalled that at the annual dinner of the general staff of the railway, held at Bath in February last, Mr. G. H. Eyre, the Traffic Superintendent, gave a very encouraging account of the position of the line, and it may be added that the increase of traffic is occasioning some anxiety to the heads of various departments. The engine lately put to work the more important passenger services of the railway is one of the most recent rebuilds of 4–4–0 Midland express locomotives—No. 499, bearing the re-building date "1913," and similar in every detail to No. 483, illustrated, with particulars of principal dimensions and special features, in the RAILWAY MAGAZINE (April, 1913, page 328). In September, 1911, a modern Midland engine of different design, No. 2023, of the $\frac{0\text{–}6\text{–}4}{T}$ type, made experimental trips over the Somerset and Dorset line, but the class was not as a result brought into general use on the system. The 4–4–0 rebuilt engines, of which No. 499 is one, are very frequently seen on the Mangotsfield and Bath branch of the Midland Railway, but the employment of this type on the Somerset and Dorset line has been a distinct innovation.

* * *

FIVE years ago a young clerk in the traffic department of the London and South Western Railway hit upon the "Easter Egg" as an approximate advertising device for the hoardings at Easter. The North Eastern Company recently improved upon this conception by displaying in the large window of their City office in Gracechurch Street, London, a collection of "Easter eggs," with an effective background of photographs which revealed some of the beauty spots on that railway. About eight inches long, each egg bore in colour either a similar representation or some equally appropriate subject, such as a map of the system, an early or a modern train, locomotive and train, or the colours of a local football team. Mr. J. Foster Stackhouse was responsible for the very effective art work introduced in the design, and Mr. E. A. Labrousse, the company's district agent, for the arrangement of the ingenious scheme, which attracted much admiration.

* * *

NEGOTIATIONS between the Railway Clearing House and the National Canine Defence League have resulted in the issue of some new regulations for the carriage by rail of unattended dogs. The League called attention to three points—(1) The insufficient accommodation when dogs were in boxes or baskets; (2) lack of food and water; (3) delay in transit and delivery. It is obviously impossible for the companies to undertake the supply of food in such cases, but they have promised that when senders give the necessary intimation in writing upon the transit labels, arrangements shall be made wherever practicable to supply the animals with water while they are travelling. Every endeavour will also be exerted to prevent delay in the carriage and delivery of dogs. With these arrangements the League express entire satisfaction.

* * *

Locomotive Magazine Souvenir No. 22, published by the Locomotive Publishing Co., Ltd., at 1s. net, is devoted entirely to reproductions of photographs of British express trains by Mr. F. E. Mackay, and is a corresponding brochure to that issued twelve months ago. Most of the photographs have been reproduced in the RAILWAY MAGAZINE, and as now presented in the form of large mounted collotype prints their value is much enhanced. A London and North Western Railway express is shown ascending the Shap incline; a second view depicts the Midland 10 a.m. Leeds–Carlisle express *viâ* Ingleton picking up water at Tebay, London and North Western Railway, while other illustrations are of principal trains on the London and South Western, Lancashire and Yorkshire, Great Western, South Eastern and Chatham, London, Brighton and South Coast, Great Central, Great Eastern, Great Northern, Caledonian and Glasgow and South Western Railways.

* * *

THE latest set of ten express locomotives of the "Court" type—now officially known as the "2900" class—is at present under construction at the Swindon works of the Great Western Railway. No. 2951, the first of the series, is *Tawstock Court*, while No. 2952 is named *Twyneham Court*, No. 2954, *Tockenham Court*, and No. 2955, *Tortworth Court*. These engines are of the 4–6–0 two-cylinder type, with outside cylinders and the standard coned boiler and Belpaire fire-box. After largely adopting the practice of painting over the brass domes on their engines, whether used for passenger or goods traffic, the same company's locomotive department has recently put into service a number of the older locomotives, comprising representatives of the 2–4–0, $\frac{2\text{–}4\text{–}0}{T}$ (side tanks), and $\frac{0\text{–}6\text{–}0}{T}$ (saddle tank) classes, in which the safety-valve casing over the fire-box has been similarly treated.

* * *

THE nineteenth annual competition for the North British Railway Ambulance Challenge Cup took place last month in the Trades' Hall, Glasgow. Conducted under the auspices of the St. Andrew's Ambulance Association, the competition consisted of a practical demonstration of treating the injured and the transport of the injured, as well as an oral examination, 10 min. being allowed for examination in each of the three trials. The examiners were Drs. Johnstone and Graham, Edinburgh, and Dr. Campbell, Glasgow. Twenty-two teams, with five men in

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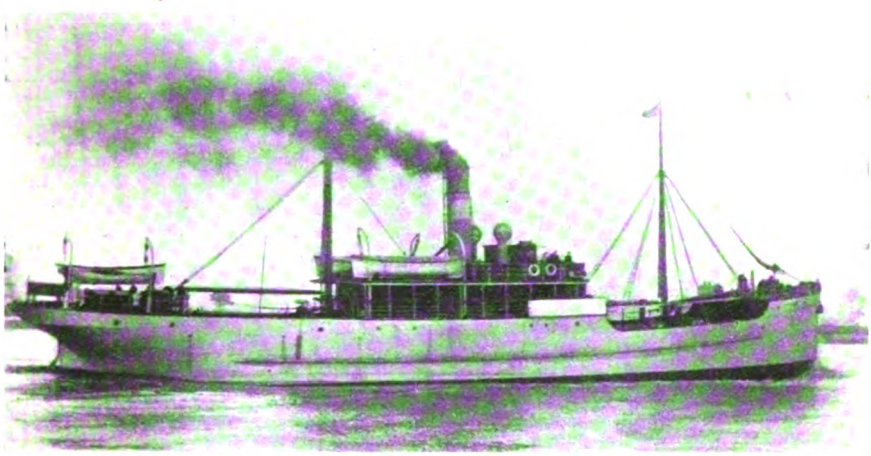
each, took part, and the result, announced by Mr. Andrew, Chief Goods Manager, was that the Methil team won the cup (which is held for a year), Queen Street (passenger) team being second, Waverley Station third, and Leith District fourth. During the past year 98 of the company's employés gained certificates of proficiency in ambulance work. The arrangements in connection with the competition were carried out by Lieut.-Col. Barnes, of the St. Andrew's Ambulance Association, and Mr. Murray, of the General Manager's Office, North British Railway Company.

* * *

THE "Channel Queen," British built throughout and completed in October last, is now on the London and Channel Islands Steamship Company's service between London, Jersey and Guernsey. Increasing popularity of this trip has necessitated an addition to the passenger accommodation, and the appearance of the new steamer has had the effect of doubling the number of passengers carried. Larger and rather more powerful than the company's other vessels, the "Channel Queen" is capable of a speed of nearly 12 knots. She contains sleeping accommodation for 45 passengers—mostly in four-berth and two two-berth cabins—and the average deck and cabin space per head is exceptionally large. There is a smoking saloon aft, and a large dining saloon amidships; while a sheltered promenade deck amidships affords an unbroken walk of 160 ft., and there is further deck room on a spacious poop. The new vessel adds considerably to the pleasure of one of the most convenient, cheap and enjoyable sea trips from London.



S.S. *Channel Queen.*

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WE have received particulars of the new P. & O. service from Immingham to India and the Far East, inaugurated in June last. The first outgoing steamer was the *Sicilia*, which took a cargo of 1,150 tons for Calcutta. The *Novara*, *Ceylon*, *Candia*, *Nagoya*, *Simla*, *Malta*, *Nankin* and other vessels have since sailed, the destination being alternately Colombo and Calcutta by one, China and Japan by the next. After taking in part cargo at Immingham, some of the steamers mentioned complete loading in London, while others reverse the process, and, finishing loading at Immingham, sail direct to the East. Up to the present time, no passengers have been embarked at Immingham by any of these vessels.

* * *

IN the Brazilian city of Bahia people are being transported between the upper and lower levels by the Pillar Incline Railway up an 83½ per cent. grade. Often called San Salvador, the city is built upon two levels, the business portion, three miles long, lying on a narrow strip of land which follows, a little above high water level, the shores of Bahia de dos Todos os Santos, while the residential area occupies a bluff 120 ft. to 150 ft. above sea level, rising from 200 ft. to 1,000 ft. inland from the bay. An incline cable railway is one of the chief means of transportation between the two levels. The cable system of haulage is employed, and the weight of the car is delivered to the truck at the four corners through coil springs placed within sliding sleeves—an ingenious arrangement, which has ensured permanent alignment, easy motion without vibration, and logical distribution of weight. Each car has a seating capacity for 20 persons, and including the running gear its total weight unloaded is 6,320 lbs. The wheel base is 9 ft. 9 5/32th in., the diameter of the wheels being 24 in.

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LORD KENYON, K.C.V.O., Gredington Park, Shropshire, has joined the Board of the Cambrian Railways Company. For some years Lord Kenyon has been a director of the London and North Western Railway.

* * *

THE Metropolitan Railway Company have recently opened an information bureau in

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the new Arcade at Liverpool Street station, where full particulars may be obtained of all matters concerning the various branches of the company's business, including season ticket rates, excursions, week end and pleasure party rates, the arrangements for the carriage of goods and parcels traffic, vacant land, houses and shops to let. Descriptive guides and geographical post cards may also be had at the new office. This departure will undoubtedly be of great service to a large number of people. The office is open throughout the day, and attention will be given to any telephonic enquiries made to London Wall 8072. A tastefully prepared poster drawing attention to the new bureau has been issued by the company.

* * *

ADDITIONAL facilities for workmen have been provided on the London and South Western Railway from Woking and Byfleet to Weybridge, the object being to add to the convenience of the large number of bricklayers, plumbers, carpenters and others engaged in building operations during the spring and summer months in these rapidly growing districts. Up till Tuesday, September 30, a new train is running daily, starting from Woking at 5.15 a.m., and from Byfleet at 5.21 a.m., arriving in Weybridge at 5.26 a.m. The workmen's return fare Woking to Weybridge—over 5 miles each way—is 5d. and from Byfleet to Weybridge, 3d.

* * *

A BODY found in the Thames at Shepperton has recently been identified as that of Dr. Sealy, of Weybridge, who was supposed to have been accidentally drowned on Christmas Eve, 1907. The unfortunate gentleman was insured against accident by the Railway Passengers Assurance Company, of 64, Cornhill, E.C., and the Company paid the sum assured on the evidence submitted to them, although the body had not then been discovered.

* * *

MR. P. A. COLLINS, the new Goods Manager of the Taff Vale Railway, joined the service of that Company in 1883 as Assistant Goods Clerk, at Penarth Town Station, and remained there for two years. He was then transferred to the Traffic Manager's Office, where he was engaged for eight years. He next accepted a position in the Goods Manager's Office, and after passing through various departments, was made Chief Clerk two years ago.

* * *

IN our last issue (page 301) a photogravure was reproduced, representing nine types of Great Western locomotives. Copies of this plate (20 in. by 15 in., suitable for framing), may be obtained at the offices of the RAILWAY MAGAZINE, 30, Fetter Lane, Fleet Street, London, E.C., price 6d. net; by post in tube, 7d.

* * *

THE 1913 edition of the Great North of Scotland Railway's list of furnished lodgings, in districts served by that line has been issued. In addition to a pictorial map, there are descriptive articles, some illustrated, dealing with places of interest, before coming to the principal contents of the book. Information is also given as to travel facilities on the system. Copies of the book may be obtained on application to Mr. George Davidson, General Manager, Great North of Scotland Railway, Aberdeen.

* * *

"THE Trade of Hull and the Humber Ports" is a useful annual issued at the price of one penny by the *Eastern Morning News*. A wealth of valuable information is included, and railway and dock progress in the district is carefully recorded. Immingham Dock and the Hull and Barnsley and North Eastern facilities on the Humber receive due attention, and special reference is made to the work of the new Joint Dock and the Alexandra Dock at Hull.

* * *

A FIGURE long familiar in the railway world of the West of England has been removed by the death of Mr. R. L. Grant Vassall, who was the oldest solicitor in Bristol, and chairman of the Taff Vale Railway Company. After being for many years a director of the company, Mr. Vassall was elected deputy-chairman in 1892 and

MR. P. A. COLLINS, GOODS MANAGER, TAFF VALE RAILWAY.

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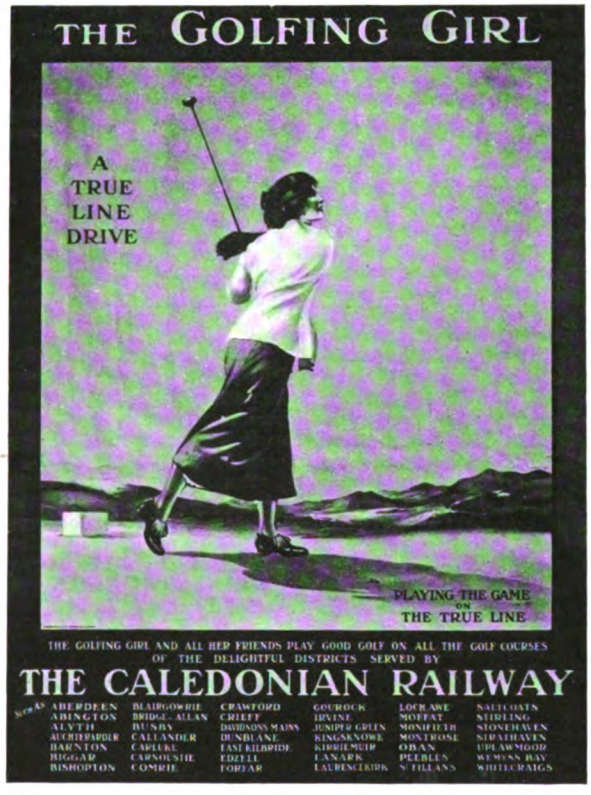
chairman in 1899. He took a prominent part in the action brought in 1900 by the company against the Amalgamated Society of Railway Servants, and it will be remembered the proceedings resulted in the passing of the Trade Disputes Act. The action arose out of the strike of 1900, and the House of Lords decided that a trade union could be sued in its registered name as a corporate body. Subsequently the society agreed to pay the company £23,000. Mr. Vassall had reached his eighty-fifth year, and was very highly respected.

* * *

THE Avon India Rubber Co., Ltd., of Melksham and London, makers of the well-known Avon tyres, are rapidly extending their business owing to the increasing appreciation of their tyres. Since the beginning of 1911 no fewer than six branches have been opened. The latest is in Paris, where M. de Lalande-Joulin is in charge of the premises at 88, Avenue des Ternes, Paris.

* * *

COPIES of several posters recently issued by leading railway companies possess features of special merit. "The Gateway of the North" is the text of one received from the London and North Western. Needless to say, Euston station is meant by this description, and a view of the historic portico appears. A modern note is struck by the tube tunnels, which show that Euston is the gateway whereby all parts of London are brought into connection with the London and North Western system. Indications which tell that transfer between the "tubes" and the main station at Euston "can be made under cover all the way," and that lifts are available from one level to the other, substantiate the claims that Euston is now one of the most accessible termini in London. From the Lancashire and Yorkshire Railway comes a poster directing attention to the attractive residential districts served by the electric trains. The chief feature here is a scenic map showing the direct route from Liverpool to Southport, and Crossens—never far from the seashore—and the branches to Aintree and Ormskirk. A fine view of an electric train, and an illustration of a modern country villa appear as insets. The general effect, with appropriate colouring to the pictorial sections, wide brown border and letterpress in white, is pleasing. Cheap season tickets, frequent trains, moderate rents and rates, and easily accessible golf courses are recommendations in favour of the districts served, and copies of a booklet giving further information may be obtained from Mr. A. Watson, Superintendent of the Line, Victoria Station, Manchester. Of late years the Caledonian Company have made extensive use of posters in which vivid colour effects are combined with appropriate letterpress, and several new issues are particularly distinctive. One is alliterative on the letter "T." "The time tables tell the trains" is, perhaps, a somewhat superfluous intimation, as one might well ask for what else are time tables published? But in conjunction with "Convenient Travelling," "The True Line to Country Life," and a list of "Delightful Districts in Summer Time," enumerated with due emphasis on the letter "T," one is compelled to acknowledge the effectiveness of the poster. Another is designed on the lines of a conventional setting sun, the middle portion directing attention to the fact that the Caledonian Railway serves many "Centres for Holiday-making in the Land of the Gael, on the Callander and Oban Railway," Sol's rays indicating the principal resorts in question. A third poster in large shaded white lettering on a blue ground and with a bright red border, announces that "England is best reached by the Caledonian Railway, the true line of way there and back." An illustration is here given of a fourth poster, which forms a companion to one previously issued.



"PLAYING THE GAME ON THE TRUE LINE."

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A DEMONSTRATION of flash-light signalling was given last month by The Gas Accumulator Co. (United Kingdom), Ltd., at Alexandra Park Race Course. At one end of the ground a gantry

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was erected carrying three signal lamps, London and North Western and Midland standards, with an "Aga" lamp between them, and at the other end was an "Aga" lamp with a Coligny illuminated fishtail lamp below. These could be viewed clearly up to half a mile away, so that a test approximating to working conditions was secured. In the case of the three-lamp gantry all lights showed clearly, but the flashing lamp was most distinctive, though at the same time it did not introduce any confusing effect as regards the lights on either side, either with red or with green spectacles. Comparison with the illuminated fishtail was, however, very marked. The latter seemed to lose most of its distinctiveness as distance was increased, while the effect of the "Aga" light became more marked. There is much to be said for the employment of the "Aga" system for differentiating "distant" from "stop" signals at night, but when more than one "distant" light is carried on a bracket post or gantry, its use ought to be restricted to direct line or high speed "distants." This policy opens a wide field of usefulness, though it does not provide a complete solution of the distant signal problem. If a driver of a direct line express can be assured that throughout he will be directed by flashing "distants," one of the great problems of train working will certainly be solved. On isolated posts, or when placed under a "stop" signal, the flashing light is quite satisfactory. Acetylene dissolved in acetone is used, and in this condition the gas is regarded as being quite safe, as it is for many other purposes, and the apparatus is automatic. A lamp will usually "run" for about two months without failure or attention on one reservoir charge, and the cost works out at about one halfpenny per day. It is, therefore, hardly worth while to extinguish the light during the day, and thus it is always available in case of sudden darkness or fog. The brightness of the acelytene light is, of course, a further advantage, and the apparatus is recognised as being thoroughly trustworthy. A large number of these installations are at work in Sweden and Russia. In many other countries trial equipments have been erected, and it is believed that at an early date similar experiments will be made in the United Kingdom.

* * *

SINCE Monday, 31st March, electric trains have been running every five minutes in each direction on the East London Railway, and the six companies concerned as lessees have, we are glad to state, every reason to be satisfied with the first results of the new system of haulage. From Shoreditch the first train starts at 5.19 a.m., and arrives in New Cross at 5.32 a.m., after stopping at Whitechapel, Shadwell, Wapping, Rotherhithe, and Surrey Dock. The last train leaves Shoreditch at 12.12 p.m., and reaches its destination at 12.25 p.m. From New Cross the earliest departure is 4.43 a.m. and the latest 11.43 p.m., the journey of 5¾ miles, with five stoppages, occupying exactly 13 minutes. To a vast industrial population living or working in the Eastern and South-eastern districts, the electrification of the East London Line cannot fail to be a great boon. For the "shuttle" service between Shoreditch and New Cross two-car Metropolitan trains are used, one vehicle in each pair being a composite coach. The through trains to South Kensington comprise four cars. Signalling is automatic all-electric, on the Mackenzie-Holland and Westinghouse alternating current system. Lamp signals are used on the tunnel sections, but the semaphores installed in the open have three spectacles, two red or two yellow and one green, to ensure that a green light is only shown when the signal is virtually fully "off."

* * *

AT a public presentation to Mr. George Kay, who recently retired from the position of station master at Penge, South Eastern and Chatham Railway, the recipient gave some reminiscences of his long railway career extending over 48 years. Two amusing incidents may be recorded. Many years ago when he was a booking clerk two boys approached the office window. Each nudged the other and said, "You go." At last one requested "Two halves to the Elephant and Castle." Mr. Kay inquired, "How old are you?" "Eleven years," replied the lad. "Who is the other half for?" "For my brother," was the answer. "And how old is your brother?" "Just a month younger than I am, sir." One day, at Penge, two ladies came to the station and wanted to go to the City. Number 1 asked, "Which end of the train for the City?" He replied, "Right behind." Then Number 2 queried, "What! Right behind?" Mr. Kay responded, "No, not quite 'right behind,' or you will get left behind."

* * *

A NEW edition of the Great Northern Railway "Holiday Manual" is available. In addition to particulars of hotels, boarding establishments, and apartments, comprehensive information is included concerning the places of interest and holiday resorts served by the Great Northern Railway and its connections, while coloured plates and other illustrations give this volume an attractive appearance. Copies may be obtained gratuitously at stations, town offices, or direct from the Advertising Department, Great Northern Railway, 3, York Road, King's Cross, London, N.

* * *

REDUCED reproductions of the now well-known "New Line to Watford" poster, issued a few months ago by the London and North Western Railway, have been prepared in the form of transparencies, adapted to be affixed to glass windows and the like. The result is exceedingly satisfactory, the colours being well brought out, while at the same time no restriction is placed upon the light passing through.

* * *

COMMENCING May 1st, the train service on the London and North Western Railway, between Northampton and Leicester, *via* Market Harborough, will be greatly improved. The express day service between London and Belfast, *via* Stranraer and Larne, is to be reintroduced on Saturdays during June and daily (except Sundays) from July 1st. A number of improvements in the train services on various routes will also be brought into force on May 1st. While the full summer arrangements will not apply until July 11th, several important trains will commence running on July 1st.

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ALF COOKE LTD LEEDS

GREAT WESTERN RAILWAY SIX-COUPLED EXPRESS LOCOMOTIVE, No. 2934, "BUTLEIGH COURT."

FITTED WITH SWINDON SUPERHEATER.

DESIGNED BY MR. G. J. CHURCHWARD, CHIEF MECHANICAL ENGINEER.

CYLINDERS 18½ IN. DIAMETER. STROKE 30 IN DIAMETER OF COUPLED WHEELS, 6 FT. 8½ IN.

TOTAL HEATING SURFACE, 2128 SQ. FT. STEAM PRESSURE, 225 LBS PER SQ. IN. GRATE AREA, 27 SQ. FT.

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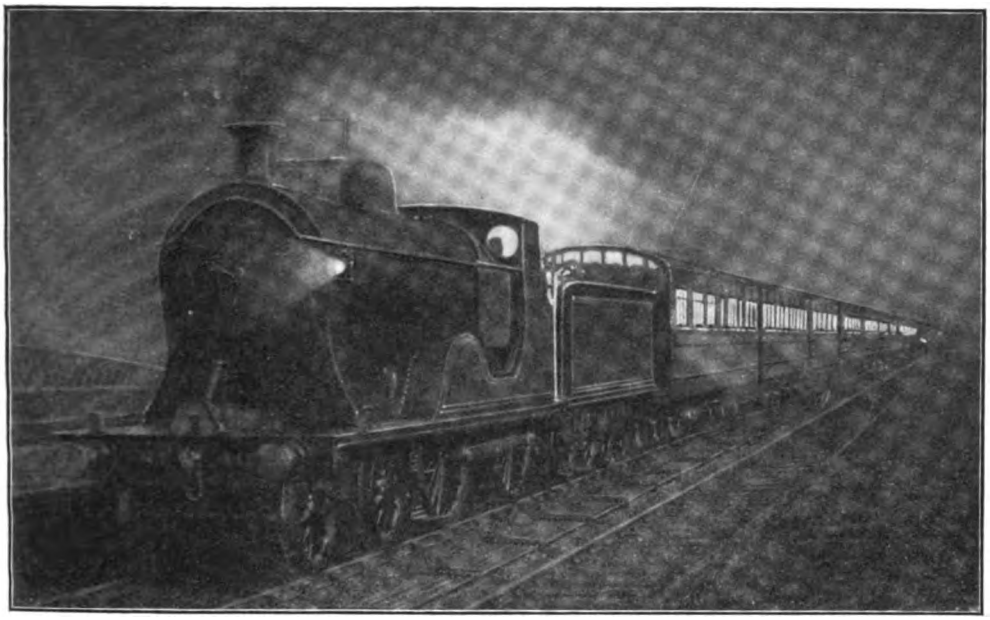

A BOAT TRAIN FROM WATERLOO TO SOUTHAMPTON DOCKS: LONDON AND SOUTH WESTERN RAILWAY.

LONDON TO PARIS:

The Southampton-Havre Route.

By W. T. PERKINS.

THE TRADE OF HAVRE.

GREAT schemes of development are progressing in connection with the London and South Western Railway route to Paris *viâ* Southampton and Havre. Since it came into the possession of that company, the old Hampshire port has made every possible provision that cross-channel and ocean services can demand, and the directors are fully prepared to meet any requirement to which the future growth of traffic may give rise. Having first established special train services to and from Waterloo station, and made arrangements whereby the transfer of passengers and baggage from rail to steamship becomes a simple and an expeditious process, the company have called to their aid the latest and most approved type of turbine engine, which, while reducing the time occupied on the sea passage, has added appreciably to the comfort and pleasure of all classes of travellers. To these praiseworthy efforts the French Government are generously responding, by undertaking improvements which will not only strengthen the lines of communication between Southampton, Havre, and Paris, but promote the activities of the latter port as a potential distributing centre for the trade of the world.

Marseilles ranks first among the French ports in respect of total trade volume, as measured by weight, but Havre offers much greater accommodation than any of its neighbours, and every year receives fully 29 per cent. of the national imports by sea, while more than 80,000,000 francs are annually paid in Customs duties upon its shipping, or 38 per cent. of the total amount collected at all the French ports combined. But when examination is extended to the character of the imports, it will be seen that

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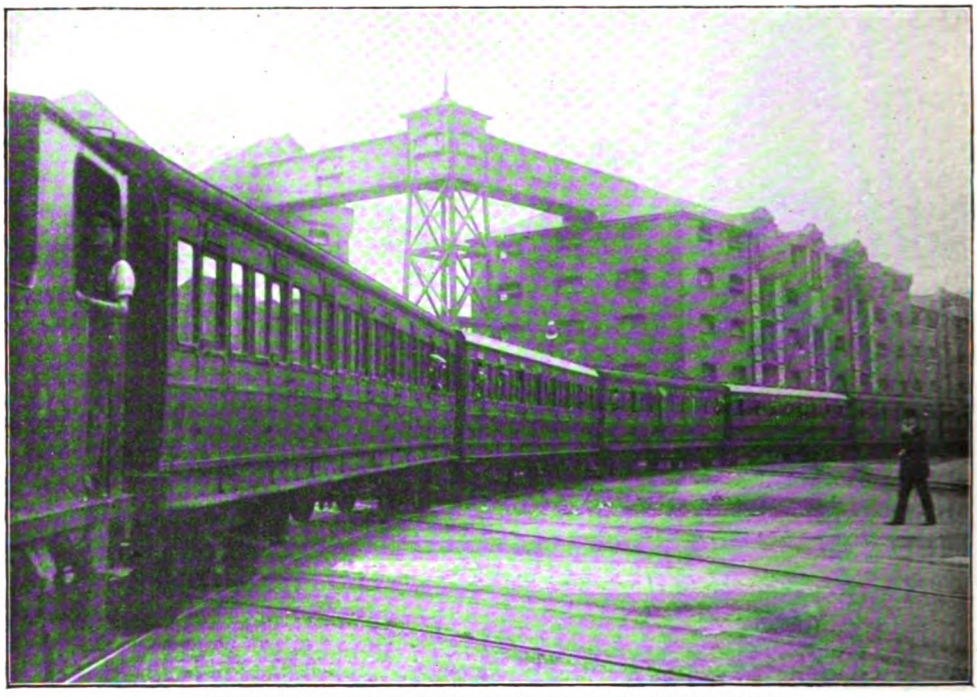
Havre easily holds first place, and on this point the following figures relating to the year 1909 may be taken as representing the normal results in respect of value per ton imported :—

Havre	676 francs
Marseilles	391 „
Dunkirk	413 „
Bordeaux	171 „
Rouen	77 „

Occupying an effectively fortified position on the North bank of the Seine estuary, Havre forms the terminus on the seaboard of the Western of France Railway, now the property of the State. Founded by Louis XII. in 1509, it was handed over to the English by Prince de Condé, the Huguenot leader, in 1562, but recaptured by the French two years later. Subsequently, at long intervals, British forces twice ineffectually bombarded its stout sea defences ; but since those days of international strife, the old fortifications of the town have for the most part been abandoned, and in their stead spacious boulevards, exceedingly handsome buildings, and many rows of excellent shops have appeared. Hotels are numerous, and as a rule good ; there is an efficient and far-reaching system of electric tramways, and ample variety is found among the houses of entertainment. In these altered and happier circumstances, the stream of visitors is naturally every year increasing, and there, as in Paris, Rouen, and every other great centre of population in France, Englishmen are now able to count upon a welcome that is sincere in its cordiality.



ARRIVAL OF A CONTINENTAL TRAIN AT SOUTHAMPTON DOCKS.

Harbour Accommodation.

At present the port comprises a tidal harbour or outer port and ten main docks, each designed to accommodate particular trades. There is a floating dock and six dry docks, but having regard to the size of modern tonnage, the latter must be regarded as comparatively small, as the largest does not admit vessels exceeding 550 ft. in length ; but, as explained hereafter, this disadvantage will speedily disappear.

In the outer harbour there is at spring tides about 32 ft. 2 in. of water, and at neap tides 25 ft. 11 in. ; while at the entrance to the two principal docks—the Bassin de l'Eure and the Bassin de la Citadelle—there is at spring tides a depth of 35 ft. and 31 ft. respectively, and at neap tides 29 ft. 6 in. and 25 ft. 6 in. The largest tidal gate has a uniform width of 100 ft. The Tancarville Canal, connects at Tancarville with the river Seine, 20 miles from Havre. Its depth is about 23 ft. between the Bassin

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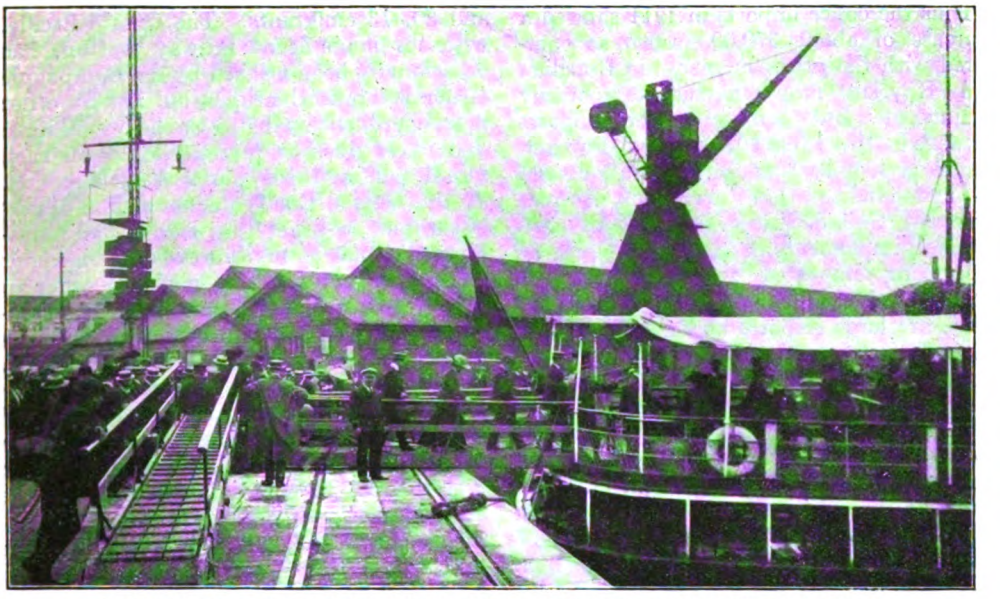
de l'Eure and the Cotton Shed, 17 ft. 6 in. from the Cotton Shed to Granville, and 14 ft. thence to the Seine at Tancarville. Upon the high chalk cliffs of Cape le Hève, on the West, there have for many years been two lighthouses, equipped with electric lights so powerful that they are visible at sea for 27 miles. But, to make the port still safer for navigation, two lightships have recently been constructed, at a cost of £32,000. These vessels are to be stationed in turn seven nautical miles north-west of la Cape la Hève, and while one remains at anchor, the other will be in port making ready to take her place in due course. Both ships are furnished with the most approved signalling apparatus yet devised—aerial, submarine and hertzian



PASSENGERS EMBARKING AT SOUTHAMPTON IN THE DAYLIGHT STEAMER FOR HAVRE.

—and they constitute a very important addition to the shipping facilities of the port. At the same time, the establishment of a floating lightship will, as Mr. H. L. Churchill, the British Consul-General, has pointed out, "help materially in the much discussed question of the distance zones with reference to vessels coming to this port being obliged to take up a pilot at the entrance to the channel, and pay excessive pilotage dues."

The tonnage of Havre inwards and outwards, which had reached 9,571,904 tons in 1910, came to 10,056,050 tons in 1911, showing an increase of 486,746, and in 1912 the figures were 10,159,142 tons. The growth in 1909 was 136,099 tons, and in 1910 306,007 tons, so that the advance of nearly 490,000 tons in 1911 was particularly satisfactory to the Chamber of Commerce. Dues levied by that Chamber in 1911 amounted to £58,755, as against £57,204, or an increase of about £1,560. Cotton and coffee form the principal features of the import trade. Large cotton-laden steamers now have the advantage of discharging their cargoes immediately in front of a very large shed erected on the Tancarville Canal by the Chamber of Commerce. This cotton shed is without rival in Europe. It has a superficial surface of 686 metres by 123 metres, and is provided with 18 electric cranes for working cargoes. On an average 1,000,000 bales of cotton are annually imported, representing about 225,000 tons, and a value of £14 to £15 per bale. These imports are calculated not by year, but by season, which is usually considered to begin on 1st September. The latest figures available are the following :—Season 1910-1911, 1,008,273 bales ; Season 1911-1912, 969,127 bales. The French cotton trade is virtually controlled by Havre. Exceptional facilities exist there for getting money, by reason of the low rate of interest charged by the Bank of France, and warehouse rents are exceedingly moderate.

Havre is also recognised as the most important coffee port in the world, and the

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movements at the docks in the years 1910 and 1911 were as follow:—

Brand.	Imports.		Cleared.		Stocks.	
	1910.	1911.	1910.	1911.	1910.	1911.
	Sacks.	Sacks.	Sacks.	Sacks.	Sacks.	Sacks.
Brazil	841,946	568,720	1,071,773	800,024	2,125,911	1,894,607
Hayti	330,319	242,284	236,037	265,384	150,421	127,321
West Indies and Central America	329,147	312,046	289,325	373,321	217,451	156,176
India, Java and Malabar	67,493	75,798	57,266	77,080	65,209	63,927
Africa and other countries ..	26,683	28,724	29,532	30,339	19,786	18,171
Total	1,595,588	1,227,572	1,683,933	1,546,148	2,578,778	2,260,202
Unloading ..	..	..	..	..	72,185	86,800
Grand total	..	..	..	..	2,650,963	2,347,002

Thus the coffee imports in 1911 showed a decrease of about 370,000 sacks as compared with the previous year, the Brazilian and Haytian crops having temporarily diminished. But last year the imports advanced to 1,398,307 sacks. Further, Havre is a collecting port for all classes of merchandise that arrive in France from the United States—grain, lard, agricultural implements, and copper—just as everything imported from the East is received in Marseilles. From the West Indies there are large imports of logwood, and in the transit trade considerable quantities of French manufactured goods—familiarly known as *articles de Paris*—dresses and many more things that ladies require are landed for re-shipment to the United States. Silk imports from Lyons represent another valuable item, and the imports of coal in 1911 were 848,785 tons, of which 841,727 tons came from the United Kingdom, 574,540 tons being carried in British ships.

For many years Havre has been the headquarters of the Compagnie Générale Transatlantique, whose liners, carrying mails, passengers, and general cargo make, at fixed times, passages to and from New York, while other vessels belonging to the same company convey first and second-class passengers, emigrants, and large quantities of merchandise across the Atlantic. *La France* (24,000 tons) is one of the latest additions to the fleet of mail steamers. The total number of passengers carried by the line from Havre to New York during 1911 reached 60,440, as compared with 73,030 in 1910 and 62,311 in 1909. Of the 1911 total, 4,723 were first class, 16,839 second class, and 38,878 emigrants. From New York to Havre 42,606 passengers were carried in 1911, composed as follows:—4,194 first class, 7,899 second class and 30,513 emigrants. The Quai d'Escale, with its magnificent railway station, has occasionally been utilised by the Compagnie Générale Transatlantique, but not by other passenger lines, owing to the heavy pilotage and other dues at present levied on such vessels coming to the port. Vessels moored at the Quai d'Escale do not suffer during boisterous weather as many had anticipated, and a revision of the harbour charges will no doubt be made, in order to give greater encouragement to similar steamships. It may be added that this enterprising French company have also established a four-weekly service of passenger steamers between Havre and Canada. The arrival port is Quebec in summer and Halifax in winter, the steamers calling first at Dunkirk and then at Havre. For this service the steamship *Caroline*—length 131·5 metres, displacement 12,650 tons, net tonnage 7,215—and the steamship *Floride*—length 131·4 metres, displacement 12,610 tons, net tonnage 7,060—are employed. Both have wireless telegraphy.

The Chargeurs Reunis Compagnie is another important French line, whose steamships trade between Havre, Brazil, and the River Plate, taking passengers and immense quantities of manufactured goods and produce, while the same company have another line of vessels running to the West Coast of Africa. Indeed, it may without the least exaggeration be stated that steamers of all nations call in the port, either bringing or taking away cargo. Thus business is done with every part of the world. There is, in addition, an important and growing coasting trade, in which vessels regularly ply between Havre and Hamburg, Havre and Bordeaux, Havre, Norway, Sweden and Denmark,

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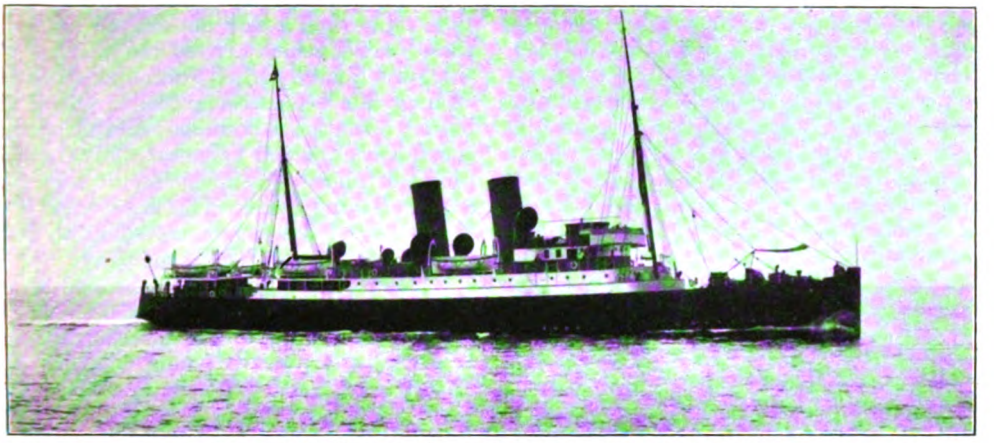

R.M.S. *Normannia* : SOUTHAMPTON-HAVRE SERVICE.

Havre and Antwerp, Havre and Spain. The Messageries Maritime steamers also run frequently between Marseilles and Havre. Then there are the numerous pleasure boats which go to and from Honfleur, Caen, and Trouville, sailing at short intervals during the summer months, and maintaining a curtailed but useful service in winter. The permanent wharf of the London and South Western Railway is close to the quays where these vessels embark and disembark passengers. Consequently pleasure seekers experience no difficulty in the transfer from the Southampton steamer to those going to one or other of these popular resorts on the French coast.

There are two well known and extensive shipbuilding establishments in Havre, one being the Forges et Chantiers de la Mediterranee, wherein merchant steamers and warships—especially torpedo boats and destroyers—for the French and foreign governments are always being constructed. The other yard is that of Augustin Normand, whose specialities are similarly torpedo boats and destroyers, which during recent years they have turned out in considerable number. This firm is, indeed, regarded as the Thorneycrofts of France. Among homes of great scientific and manufacturing industry, comes next the famous Creusot Works, whence some of the most powerful guns in the world have for generations gone forth, including many used by the Allies in the war against Turkey. There are likewise prosperous dye works; a cotton spinning mill, from which there is a large output; and several engine works, headed by the firm of Messrs. Caillard, who have earned a high reputation in France, particularly in connection with the building of cranes.

Much of the success of the port has been due to the efforts of the firm of Messrs. Langstaff, Ehrenberg and Pollak, one or other of whose principals has represented the London and South Western Railway ever since the company became responsible

CAPTAIN H. KERNAN.
R.M.S. *Normannia.*

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for the steamship connection between Southampton and Havre. This was in 1849, when they agreed to lease and maintain the fleet of the South Western Navigation Company, whose undertaking they acquired in 1862. The father of the present agent occupied that responsible position for half a century, and at his death in 1900, his son, Mr. William Ramsay Langstaff, who had worked with him in the offices on the Grand Quai since 1877, was appointed his successor. Mr. Langstaff is very highly respected in the port, and his services to the railway company have been of immense value. For 13 years he has acted as Consul for Japan, and he is an *officier* of the Order of the Sacred Treasure—a distinction which, with the permission of King George, he is at liberty to wear in the United Kingdom.

CAPTAIN A. E. HOWE.
R.M.S. *Hantonia.*

PORT IMPROVEMENTS.

Credit is due to the Havre Chamber of Commerce for the succession of improvements which have during recent years been effected in the harbour and port. Under a programme of works decided upon in 1895, the Floride tidal lock was completed, enabling the largest vessels to enter the basins for 7½ hours during daytime and 6½ hours at night—an advantage of which few tidal ports are able to offer. During the first four months the lock was open over 200 passenger or cargo boats made use of it, and on several occasions three passed during one tide. Had such a lock not existed many of these vessels, which arrived too late for the tide, would have had to wait outside for the ensuing tide before being able to enter the basins. Another advantage secured is that companies of regular liners can fix their time table at more convenient hours for passengers leaving Paris. This is especially so in the case of passengers travelling to New York by the Transatlantic company.

Further programmes were decided upon in 1904 and 1909. One of the chief works included in the latter was the construction of a new wharf at the Grand Quai for the London and South Western Railway Company. The contract was entrusted to La Société des Grands Travaux, and the extension, which was begun towards the end of last summer, is being carried out with reinforced concrete (*beton armé*). During construction and until completion, the London and South Western Railway Company's steamers are placed at the Quai d'Escale, on the south side of the outer harbour (*avant port*) opposite the Grand Quai. The shed erected for this service by the Chamber of Commerce, affords ample accommodation for passengers, baggage, and Customs. To the east of the London and South Western Railway Company's temporary structure is a spacious and luxurious passenger shed, built principally for the convenience of ocean passengers.

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It is considered unique, and is most up-to-date in every respect. At present this large shed is used occasionally by the Compagnie Générale Transatlantique, but it is hoped that steamship companies will soon discover that Havre, as a port of call, offers facilities which are unattainable at other continental ports. Its close proximity to Paris, and the fact that passengers can step from the train on to the ocean steamers will sooner or later be appreciated by travellers who have had to suffer the inconvenience of transhipment by tender.

The Quai d'Escale is about a mile and a half from the railway station. Passengers are conveyed by motor omnibuses. The wharf on the Grand Quai—to the cost of which the London and South Western Railway Company are contributing—will be about 65 ft. wide by about 200 ft. long. Steamers can remain afloat there at any state of the tide, and the wharf will be supplied with two e'ectric cranes for the rapid hauling of baggage and cargo. It is expected that the normal service may be resumed towards the end of the present year. Electric trams will then meet the vessels from Southampton, and convey through passengers and hand baggage to the railway station free of charge, as heretofore. If for any reason the train connection with Paris should be missed, a special train is always

MR. W. F. BUNTING.
Chief Engineer R.M.S. *Normannia.*

MR. W. CAMPBELL.
Chief Engineer R.M.S. *Hantonia.*

started, whatever may be the number of passengers. The run to Paris is most picturesque.

Cranes which are to be put up on the new wharf will give every facility for handling motor-cars, and it must be acknowledged that the Customs authorities readily co-operate with those of the port in preventing any unnecessary delay. Formalities are quickly observed, and tourists are able to start off in their cars very soon after arrival. Two sheds are to be built on the quay by the Havre Chamber of Commerce—one for cargo and the other for passengers. Inspection of baggage by Customs is to take place in the passenger shed, which will be suitably furnished for the convenience of passengers. Space on the quay between the two sheds will be covered by a glass roof, affording ample shelter when required for arrivals or departures to and from the quay by motor or carriage. The Compagnie Normande's steamers plying between Havre, Caen, Trouville, and Honfleur are berthed at the Grand Quai in proximity to the London and South Western Railway Company's new wharf.

The work contemplated by the programme of 1909, and now under construction, includes a large outer port which will be

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Raoul Autin] [*Le Havre.*

MR. W. R. LANGSTAFF,

Head of the Marine Department, London and South Western Railway, Havre.

enclosed by moles on the North and South, a capacious open dock, several dry docks, and an inner dock—all lying to the South of the existing accommodation. This includes (1) the original outer port and the Grand Quay, whereat better loading and discharging facilities are being provided for the London and South Western steamers; (2) l'Eure Dock, (3) Bellot Dock, (4) the petroleum dock, (5) Tancarville Canal Dock, (6) Citadel Dock, (7) Barre Dock, (8) King's Dock, (9) Commercial Dock, (10) Vauban Dock, (11) a bonded dock, and several smaller basins. The object of the present scheme is to make a considerable addition to the accommodation offered by the port, and to add dry docks of dimensions sufficient to admit for repairs and overhaul much bigger vessels even than the great Atlantic and other ocean liners which are now regularly running to and from Havre. This work will involve the expenditure of over eighty million francs. It is being carried out by Messrs. Schneider, Vignier and Schmidt.

SUCCESS OF THE GEARED TURBINE STEAMERS

The introduction of geared turbine steamers in the Southampton-Havre service has proved extremely popular. Having regard to the great advance made by the appearance of such vessels, continuous expansion in the volume of traffic may be confidently anticipated. In fine weather it is a delightful sea trip, and should the French Government, as may be hoped, decide to construct a branch connecting the quays in the port of Havre with the main line of the Western of France Railway at the town station, the value of this route to Paris would be immensely increased. From the Grand Quai to Havre station the distance is barely a mile, but in these days there is on the part of a very large number of passengers a strong objection to any transfer that can be avoided in steamship and railway services. The cost of such a line would not be excessive, and for the expenditure the State would soon be recouped by the revenue which would inevitably result from a much larger traffic between London, Rouen, and Paris *viâ* Southampton.

Constructed by the Fairfield Shipbuilding and Engineering Company at their extensive yard in Govan, Glasgow, the *Normannia* and the *Hantonia*, the second pair of turbine vessels to be added to the fleet of the London and South Western Railway Company, have enabled the channel crossing between Havre and Southampton to be so much curtailed that passengers now reach London at 9 a.m., instead of 10.10 a.m. as formerly, when reliance was placed solely upon twin screw steamers. At the same time, the comfort of the voyage has been materially enhanced. As previously stated in the RAILWAY MAGAZINE, these two steamships, specially designed for the night passage, are replete with every convenience desired. The company claim that Southampton-Havre is the cheapest route to Paris, Switzerland, and Italy. They also affirm that it is the most comfortable night route; and it was to maintain this record—well established by the twin-screw steamers *Alma* and *Columbia*—that they decided to introduce turbine engines. The route is also convenient, comfortable and expeditious to the delightful watering-places on the Normandy littoral between Étrétat and Cherbourg, as well as to the old inland towns of Normandy. Previously the turbine steamer has been driven by direct-acting turbine engines, fitted with three or more propellers, and although the vibration so long associated with the

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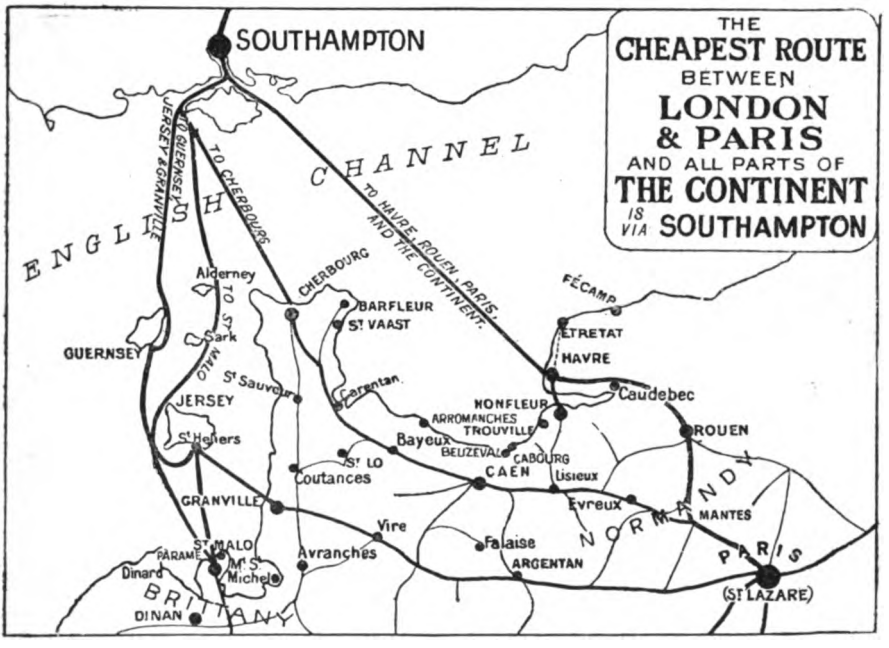
reciprocating engine was as a result of this principle minimised almost to the vanishing point, there remained an area in the stern of the ship in which there was still some vibration. In their new steamers, the London and South Western Company have adopted a design of geared-turbine propulsion with twin-screws, patented by the Parsons Marine Steam Turbine Company, Ltd., of Newcastle, and the *Normannia* and *Hantonia* are the first steamships in the mercantile marine of any country to be supplied with this type of engine.

I have to thank the Fairfield Shipbuilding and Engineering Company, Limited, the builders of the *Normannia* and *Hantonia* for the following explanation of the difference between "geared" turbines and the ordinary type of turbines:—The propelling machinery of the *Normannia* and *Hantonia* differs from the usual arrangement of turbine machinery. As is well known, the efficiency of a steam turbine is dependent upon the velocity of the turbine blades; and, in order to secure a high value for this velocity, the turbine rotor must either be of large diameter, or made to rotate at high speeds. On the other hand, high propeller efficiency cannot be obtained if the speed of rotation be too high, and consequently the latter method of securing turbine efficiency is not permissible when the turbine is directly connected to the propeller shaft. As there are many objections to the adoption of very large diameters for turbines which have to transmit comparatively small powers, *e.g.*, excessive weight and leakage losses, it is obvious that a very great improvement may be obtained in the overall efficiency by the installation of a fast running turbine driving a slow running propeller by means of suitable gearing. This method has been adopted in the vessels here referred to, the installation consisting of twin screws each driven by one h.p. and one l.p. turbine geared to the propeller shaft by steel pinions and a large steel wheel having very finely pitched and accurately cut double helical teeth on their faces. The arrangement has made it possible to fit two large propellers instead of the three small ones, as has been the practice heretofore, and as a consequence the following important advantages have been secured:—



(1) Less power is required to drive the vessel.

(2) There is a lower rate of steam and coal consumption per horse power.

(3) Further economies result in (1) and (2) due to the saving in weight consequent upon (2).

(4) Finally, and perhaps most important of all, better manœuvring control of vessel

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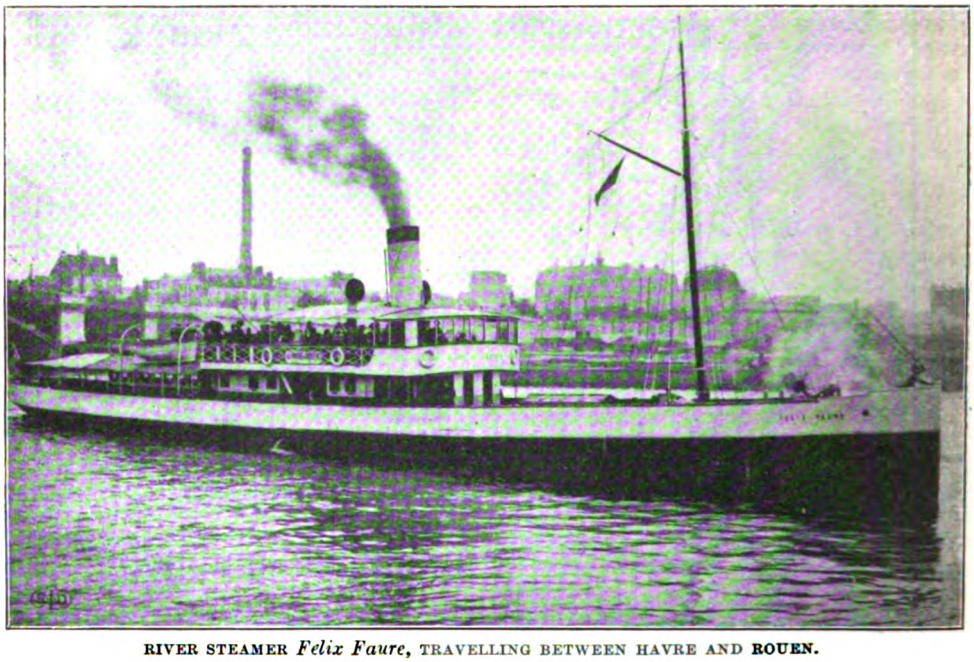
is made possible by the adoption of larger propellers.

This machinery consists, as stated, of two sets of steam turbines driving two shafts, the revolutions per minute at full power being 2,000 for the high pressure and 1,400 for the low-pressure shafts, while, by the system of geared wheels on to the main propeller shafts, the latter and the propellers are reduced to 315 revolutions. One great advantage claimed by the patentees for this type of engine was that it would prove more economical in fuel consumption than the direct-acting impulse turbine; but this is not the only advantage attached to the geared turbine. From experiments made by Messrs. Parsons, it was clearly demonstrated to the directors of the London and South Western Railway that there was another, and, as far as the traveller was concerned, a still greater advantage offered, namely, the vibration was completely eliminated, and that it was possible to sleep in the immediate vicinity of the propellers with perfect freedom from this terror to travellers by steamers driven by ordinary reciprocating engines. In actual service the two vessels have justified the highest expectations of builders and owners, and the London and South Western Company may regard their venture, as the pioneers of this new type of engine, with every satisfaction. Alike in every detail, the new steamers have a length over all of 299 ft., breadth 36 ft., and depth 15 ft. 9 in., with displacement of 1,865 tons, and gross tonnage 1,567, the passenger licence of the Board of Trade being for 1,010 passengers. The shaft horse-power of the engines is 4,986.

Luxurious Cabins.

Like the steamers which they have replaced, the *Normannia* and *Hantonia* make provision for first-class passengers in the middle of the ship, in cabins of two and four berths each. All these cabins—more "roomy" than those usually found in Channel steamers—are on the promenade and main decks, and so arranged that nearly all are outside rooms, *i.e.*, at the sides of the ship, where they secure for the occupants coolness and natural ventilation. Recognising the desire of many passengers for something more commodious than even the two-berth cabin, the owners have provided five *cabines de luxe*, each supplied with a single bedstead, so as to secure the maximum of comfort. These state rooms are situate in the best positions on the promenade deck, and are the nearest approach to a bedroom



RIVER STEAMER *Felix Faure*, TRAVELLING BETWEEN HAVRE AND ROUEN.

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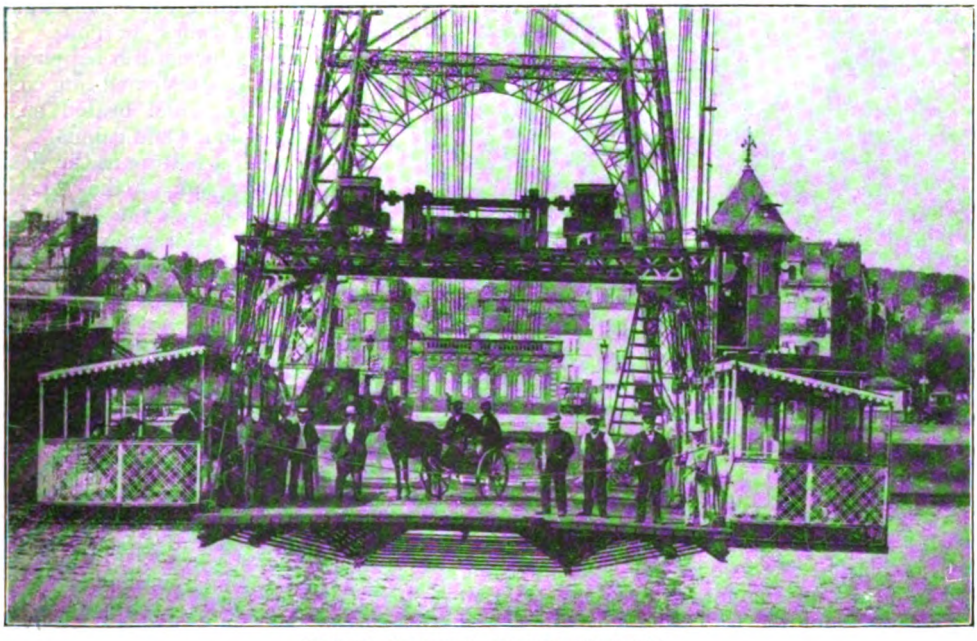
ashore that it is possible to imagine afloat. The panelling is of silver grey plane tree wood, and the furnishing consists of a single brass bedstead supplied with Marshalls' well-known Vi-spring mattress, a comfortable arm-chair, pedestal washstand (hot and cold water), and a Duchesse dressing table. Curtains of mouse colour linen plush and an Axminster carpet complete a scheme of decoration which is most pleasing and restful in its general effect.

In addition to these luxurious separate sleeping cabins, there are four public saloons. The smoking room, panelled in dark oak, with seats and revolving chairs upholstered in green leather, is on the boat deck, at the after end of the main entrance. At the fore end of the promenade deck house is the ladies' saloon, a boudoir room with lounge chairs panelled in light oak, and the tastefully upholstered settees therein provide sleeping accommodation for 14 passengers when required for that purpose. In the centre of the promenade deck—well lighted and ventilated by large skylights in the boat deck—is the general lounge. This apartment can also be utilised as a sleeping apartment for 16 gentlemen. The dining saloon is the only part of the first-class accommodation on the lower deck, and it is placed there so that all the best sleeping accommodation may be as high as possible. It is reached by the main staircase leading direct from the boat deck, and table seating accommodation is provided for 40 passengers. The panelling of this saloon is in light oak, the revolving chairs and upholstery being *en suite*. Cork lino tiling of a pattern soothing to the eye covers the floor. The main entrance on the boat deck, likewise panelled in light oak, gives access to the promenade deck by two companions leading to the main vestibule or reception room for passengers. Immediately in front is the ticket and enquiry office, faced with plate glass and a handsome brass *grille*. This office is supplied with a telephone connecting all parts of the ship, facilitating the operations of the chief steward when dealing with a large number of passengers, each pressing for attention in regard to berthing and other requirements. The entrances are covered with indiarubber tiling, and the corridors, which are particularly wide, with cork lino tiling. The boat deck of both steamers furnishes a spacious promenade, and is well supplied with comfortable sheltered seats. At the after end of this deck is situate the wireless telegraph operator's room.



THE TRANSPORTER BRIDGE AT ROUEN.

Second Class Accommodation.

The provision for the accommodation and comfort of second-class passengers marks a distinct advance upon what is usually found in cross-Channel steamers, and the company

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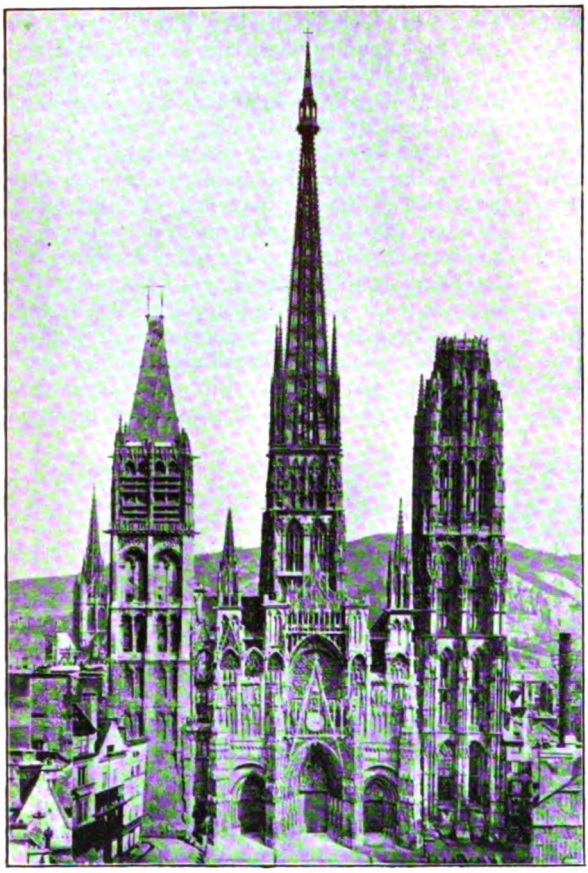
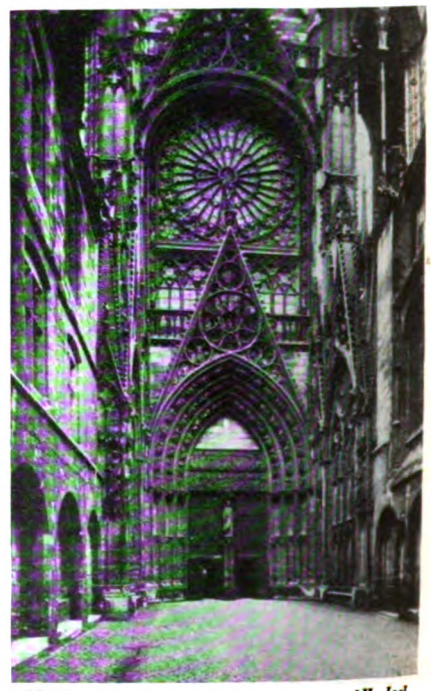


ROUEN CATHEDRAL.

may be congratulated, not only upon the excellent arrangements made, but upon the innovation of placing the saloons for ladies travelling second class on the fore-side of the after well, giving them for the first time a position within the midship area of the ship. The ladies' main saloon is on the main deck, but there is also a smaller saloon on the promenade deck, entrance to the same being obtained from the after-end of the promenade deck house. These saloons, provided with sofa berths of the Hoskins "Neptune" pattern, upholstered with blue velvet, afford sleeping berths for 30 ladies.

On the poop deck—a fine promenade in itself—is the second-class deckhouse and smoking room, fitted with pierced wood seats and tables, giving access to the accommodation for gentlemen, which is provided in the two saloons under the poop deck. Here the sofa berths, similar to those in the ladies' saloon, contain sleeping berths for 42 passengers. The lavatory and sanitary arrangements are of the most efficient type, and ample for all classes. Ventilation has always been one of the greatest difficulties to be surmounted by the designers of this type of ship, and passengers by the *Normannia* and the *Hantonia* have not failed to appreciate the attention which has been given to the point. The ventilation arrangements are the same as were adopted by the company for their new earlier turbine steamers *Cæsarea* and *Sarnia*, employed in the Channel Islands and St. Malo services, namely, the Thermotank principle, fitted by the Thermotank Co., of Glasgow, by which means fresh air is continuously pumped into every separate saloon and sleeping cabin, completely changing the air six times an hour. The heating in winter is also supplied by the thermotank, fresh air being collected by the fans, and heated on its way to the saloons and cabins.

Another novel feature in the design is the introduction of the "cruiser stern," instead of the long high counter of the older type of vessels. The after part of the ship is thus broadened out to almost the same



Photo] [*H. Joel.*

ROUEN CATHEDRAL: BOOKSELLERS' GATEWAY.

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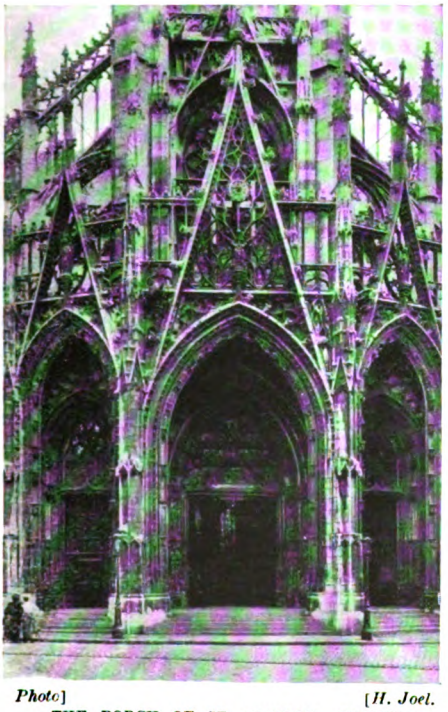
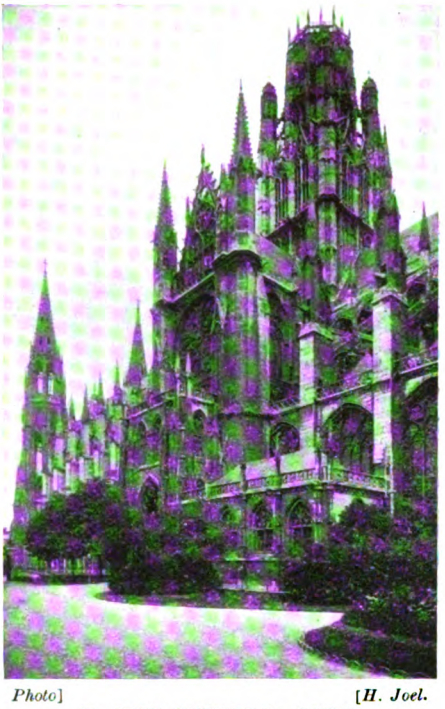
width as amidship, ensuring greater steadiness in heavy weather. The after well of the vessels is especially large and free from encumbrance for stowing the largest motor-cars and valuable horses. Constructed in excess of Lloyd's requirements for excellence of materials and workmanship, both vessels are equipped with all the appliances suggested by the Board of Trade for life-saving, and there is also an installation of the Marconi system of wireless telegraphy, together with electric light throughout, Welins' patent boat davits, and Lord Kelvin's compasses and patent sounding machine for taking soundings while the ship is going at full speed.

Havre as a Tourist Centre.

The most casual glance at the map will show that Havre is an admirable centre for tourists. It is close to Trouville, Etrétat, Caen, Honfleur, and Yvetot, while delightful Rouen, with its incomparable architectural and ecclesiastical treasures, is near at hand, on the highway to Nantes and Paris. Independent steamship services to Cherbourg, Granville and St. Malo are maintained by the London and South Western Railway in winter and summer alike; but from Havre access is given by the Western of France Railway to the whole coast of Normandy and Brittany.



Photo] [*H. Joel.*
THE PORCH OF ST. MACLOU, ROUEN.



Photo] [*H. Joel.*
ST. OUEN CATHEDRAL, ROUEN.

The charming suburb of Ste Adresse, approached from Havre by electric tramway, is being very much extended and built over by Mr. Dufayel, of Paris, who having bought up a large amount of land has appropriately named this part "Le Nice Havrais." Plans have been prepared for an 18-hole golf course, and also for a race course, both of which are shortly to be laid down. There is on the sea front a very good hotel, where moderate prices are charged, and plenty of private accommodation can be obtained in villas and flats. The "Palais des Régates," an influential private club, the headquarters of the Havre Regatta Club, is a large and handsome building, also erected by Mr. Dufayel. Temporary members are accepted on introduction, and visitors may be advised to avail themselves of the privilege. Good sea bathing, tennis, and roller skating are enjoyed at the club, which occupies a splendid position on the shore. There are fine reading and dining rooms, and regular evening entertainments during the summer months. A prosperous future is anticipated for this new part of the town. The suburb occupies a commanding situation,

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Photo] [*H. Joel.*

RUE DE ST. ROMAINE, ROUEN.

Showing the house where Jeanne d'Arc is said to have stayed when awaiting her trial.

and is a delightful addition to the many attractions of Havre. Its further development may, therefore, be confidently anticipated.

Trouville, a little further from Havre, rejoices in its reputation as the most fashionable and at the same time the most expensive resort on the northern coast of France. In the months of July, August and September its extensive sands present a scene of singular animation—English and French visitors mingling in common enjoyment with others from America and from even more distant parts of the globe. An aristocratic spirit everywhere prevails, and the new Municipal Casino is one of the most gorgeous institutions of the kind in existence. The race meeting, annually held in August on the Champs des Courses at Deauville, on the opposite side of the river, is the most important provincial meeting in France, and is always extremely well patronised, bringing together as it does a brilliant cosmopolitan throng. Golf is likewise popular, and the course of 18 holes is open until October. Harfleur, four miles east of Havre, was formerly the chief port on the Seine, also an important naval and commercial arsenal. Although, with the advance of its more progressive neighbour, much of the former influence has disappeared, it still attracts many strangers

Etrétat is easily reached by rail from Havre *via* Les Ifs, but, like other places on the same coast, is approached still more agreeably by motor. Located between two cliffs, 300 ft. high, which enclose the beach in a semi-circle, it is a favourite spot with both English and French travellers, for whom excellent accommodation is provided in nearly a dozen hotels and many villas. There is, of course, a casino with ballroom and restaurant, and therein everybody may be seen. The sea never recedes more than 50 yards on the sharply-falling beach of shingle, and bathing is one of the chief delights of the season. Golf and lawn tennis are enjoyed under equally pleasant conditions. To the little port of Honfleur—one of the oldest stations in France—steamers run every half-hour from the Grand Quay in Havre, and although not possessing any of the vivid attractions of either Trouville or Etrétat, finds compensation in perfect specimens of domestic architecture belonging to the sixteenth century.

Stebbing] [*Paris.*

MR. H. BENNETT.

Paris Representative, London and South Western Railway.

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The Gothic church of St. Catherine is remarkable in having been built exclusively of timber and plaster, and is regarded as the most important example of the kind in the country. It consists of two simple parallel alleys. Solid trunks of oak, squared in simple fashion, support the roof; cross-beams and carved brackets correspond, and wood is further seen in all the windows.

In these, as in other places of which the outer world knows comparatively little, the stranger discovers much that is extremely interesting, and everywhere meets with a kindly welcome. But of all the excursions that are open to him, none will afford so much genuine pleasure as the one by the Seine to the prosperous and famous city of Rouen. A joint arrangement effected between the Chemins de Fer de l'Etat on the one hand, and the Compagnie Rouennaise de Navigation on the other enables the journey to be made in one direction by steamer and in the other by rail. This service, beginning towards the end of May, continues to the close of September, and in fine weather a more delightful trip could not be conceived. Passengers may be recommended to furnish themselves with a copy of the illustrated guide book by M. Georges Dubosc, published both in English and French. It describes the wonderfully picturesque scenery of the Seine from Rouen to Havre, which, owing to the sinuous course pursued by the river, represents a distance of about 70 miles.

Picturesque little villages dip in constant succession down to the very banks of the stream, the setting of churches, homesteads, cafés and the rest being everywhere cast amid forest vegetation, often with chalk cliffs added to cast a bright glamour over the rustic beauty. Handsome chateaux and monastic ruins here and there occupy lofty positions, and the prevailing charm of the panorama is that no two places are alike. A peaceful serenity is all pervading, and the visitor who seeks a really restful holiday amid conditions of simple life will in none be disappointed. Rowing boats of broad beam approach the steamer from these habitations of homely folk, to take ashore or to embark the few who know of the local attractions; and not infrequently one sees among the arrivals people who have travelled from far-distant centres of industrial England to make a summer sojourn amid surroundings for which they can find nothing like a parallel at home.

ST. MALO: THE SAND AT LOW WATER: STEAMERS RUN DIRECT FROM SOUTHAMPTON.

Almost midway between Havre and Rouen stands the exceedingly pretty village of Caudebec-en-Caux, a fortified station in Roman times, and later one of affluence as the chief seat of the French hat trade. It maintains with infinite pride a handsome church, erected early in the fifteenth century, and the streets contain a large number of old houses, among which is one that was occupied by the Templars. But the feature that chiefly attracts the attention of passengers by the *Felix Faure* is the "Mascaret,"

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or tidal wave, which comes up the estuary on spring tides. Reaching far across the river, it attains a height of between 5 ft. or 6 ft., and rushing impetuously with a roar as of thunder, reaches its greatest force opposite Caudebec, beyond which point it gradually subsides. Long observation has led to the conclusion that the peculiar formation of the bed of the Seine and the contraction of the waterway at Quilleboeuf account for the phenomena. There is a gradual rise in the bottom where the water shallows as it runs up the estuary, and the consequent friction creates the tidal wave, which originates first in one quarter and then in another.

As the steamer approaches Rouen, a striking change in the scene occurs. Signs of great industrial activity suddenly appear. Spacious quays and steamers of varying tonnage indicate the existence of an oversea as well as a coasting trade. Both banks of the river are equally busy, but a bridge to connect them would seriously impede navigation. The spider-like "transporter" has, therefore, been installed, and well does this structure serve the purpose. Railways and tramways run along the quays, the latter extending far into the suburbs, including in their system the funicular line that ascends the hill to Bonsecours.

It is, however, at its civic centre that Rouen assumes its most impressive aspect. There the visitor finds architectural groupings which have no equal elsewhere in France. Space does not allow even a brief enumeration of those grand ecclesiastical edifices, the ancient religious houses, the Palace of Justice, the sixteenth century clock, the Jeanne d'Arc Tower, the costly fountains, the museums, and the innumerable historic relics found at almost every turn. All, happily, have been most jealously protected. Spacious boulevards have been carved out in overcrowded congeries of property, and much that belonged to earlier ages has inevitably disappeared. But a wonderful collection of buildings remain, and these continue to invest Rouen with positive fascination. Visitors may rely upon hotel accommodation—some of it as good as any in Europe—and a few days spent in the city cannot fail to leave many pleasant memories.

DINARD: REACHED FROM ST. MALO BY STEAMER OR MOTOR BOAT.

The rail journey from Havre to Paris—a distance of 136 miles—is covered in about 3½ hours. Formerly the railway was a section of the Chemins de fer de l'Ouest, but in 1909 the Government bought out the Company, and have since worked it as a part of the State system. In the hands of its new owners considerable improvements have been carried out, chiefly in connection with the permanent way, and other alterations for the better are contemplated. The station at Havre is well-built and commodious, and

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covered by an arched roof of glass. For the benefit of English travellers unacquainted with the French language, the London and South Western Company's Interpreter is at hand, ready to give any assistance that may be desired.

There are twelve trains daily in each direction between Havre and Paris, but English passengers usually travel by the Boat Express, which leaves Havre at 8.0 a.m., and reaches Paris at 11.22. The run by this train makes a pleasant trip, as the line follows the valley of the Seine the whole way, traversing the richest and most picturesque parts of Normandy, and touching several places of great historic interest. Four miles from Havre is Harfleur, the mother town of Havre, once a port of considerable importance, but now, in consequence of the silting of the sands at the mouth of the Seina, lying peacefully back two miles from the river. As the town is passed, one catches a fleeting glance of the graceful spire of its twelfth century church.

Beyond Harfleur the journey of 10 miles to Beauzeville-Bréauté, the first stop, is through well-wooded country. Beauzeville-Bréauté is the junction for two branch lines, one running in a northerly direction to the pretty seaside resort of Fécamp, the other going South to the ancient Roman town of Lillebonne, on the right bank of the Seine. Continuing, the train pursues its journey unchecked through Motteville (the junction for St. Valery-en-Caux), and Barentine (the junction for Caudebec) until Rouen is reached. From the railway a fine perspective of the countless spires of that beautiful city is obtained, and on the right is noticed the high hill of Bonsecours, with its Pilgrimage Church and the monument erected in memory of Jeanne d'Arc. From Rouen the line, still following the course of the Seine, passes through Sotteville, Oissel, the pretty little town of Pont de l'Arche, Mantes, where William the Conqueror died, and—running through the St. Germain Forest—terminates at St. Lazare in Paris. It may be added that St. Lazare is a convenient point from which to make a tour of the sights of the City, many places of great interest and attraction, such as the Opera House, the Madeleine, Jardin des Tuileries, the Louvre, and the Arc de Triomphe, being within easy reach.

The London and South Western Railway is very ably represented in Paris by Mr. Harry Bennett, who was born in London. The son of Mr. J. S. Bennett, the public architect of the historic monument of Casa Pia at Belem, he has served the Company since boyhood; and, during the siege of Paris, booked the final group of passengers who left the city, the Havre route being the last to be cut by the victorious German armies investing Paris. Mr. Bennett is a member of the British Chamber of Commerce, and his address in Paris is 253 Rue St. Honoré.

The train and steamship services between London (Waterloo Station), Southampton, Havre and Paris are as follow:—

LONDON TO PARIS.

Daily (Sundays excepted) July 1st. to September 30th.:—London (Waterloo) depart 9.45 p.m.; Steamer leaves Southampton 12.15 midt.; Train leaves Havre 8.0 a.m.; Train due Paris 11.22. Daylight Service, Saturdays, July 26th to September 13th:—London (Waterloo) depart 8.55 a.m.; Steamers leaves Southampton 11.15 a.m.; Train leaves Havre, 6.43 p.m. (Restaurant Car train); Train due Paris, 11.18 p.m.

PARIS TO LONDON.

On week days July 1st to September 30th (also Sundays, from July 28th to September 15th):—Train from Paris (St. Lazare) 7.48 p.m.; Steamer leaves Havre 12.0 midt.; Steamer arrives Southampton 7.0 a.m.; Train due London (Waterloo) 9.30 a.m.

The connection between the train and boat at Havre is guaranteed. Paris passengers are conveyed free between the Steamer and the Railway station at Havre.

Fare.—London (Waterloo) and Paris—Single. First class, 36s. 10d.; Second class, 26s. 10d. Return.—First class, 62s. 4d.; Second class, 44s. 4d. Single journey tickets available for seven days. Return tickets available for one month.

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Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY.

The Royal Train conveying Their Majesties the King and Queen to Crewe, April 21, 1913. Locomotives Nos. 2663, *George the Fifth* and 1800, *Coronation*.

British Locomotive Practice and Performance.

By CECIL J. ALLEN.

A CORRESPONDENT has taken me to task in respect of what he considers to be an inconsistency in my remarks concerning the new 4-cylinder 4–6–0 express locomotives on the London and North Western Railway. He quotes my observation in the April issue of the RAILWAY MAGAZINE, which was as follows: "With such performances as these in view" (*i.e.*, the exploits of the *George the Fifth* and *Prince of Wales* type engines over Shap summit) "I cannot see what can be the object of designing further engines with such a marked increment in power, unless the intention be to unite such of the expresses as at present run permanently in duplicate." This he considers to be directly at variance with my contention in the July number, 1912, that the mammoth modern locomotive, although often performing work but little superior to that of smaller types which had preceded it, had, generally speaking, justified its introduction by the comparative economies in running which it was able to effect in cases where the smaller engines would require to be "thrashed" in order to afford the same results.

At first sight, the two extracts appear to disagree, but in reality there is no conflict whatever. Among the passages in the previous article occurred the following sentence:—"The London and North Western was also cited" (by the same correspondent, to whose query I was also replying on that occasion) "as largely being a 4–4–0 line; but here is a case of a 4–4–0 engine whose dimensions well-nigh reach those of a ten-wheeler, combined with heavy, but constant loads over a perfectly graded road—at least south of Warrington—at fairly high speeds." By this statement I meant to infer that the demand in respect of tractive power on the London and North Western Railway was a fairly constant one, well within the ability of the existing 4–4–0 and 4–6–0 types—both of roughly similar dimensions—to supply. Not only so, but runs which have appeared in these columns in past issues show clearly that, on present schedules, the superheater engines have a very considerable reserve of power to meet contingencies in the way of extreme loads or lost time.

For instance, on the now famous run with No. 1595 *Wild Duck* (4–4–0) the 152½ miles from Willesden to Crewe were covered in 150 min. 50 sec. gross, or 149 min. net, with no less than 410 tons behind the tender. The latter figure represents a gain

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of 13 min. on the fastest schedule in force between these two points with a load which would be admitted as extreme, judging by the standards in force elsewhere. Yet I understand that the coal burned on that occasion, ascertained by specially weighing the engine at Crewe on arrival, worked out at the moderate figure of only 36 lbs. per mile, which proves that the engine was in no way "thrashed" to achieve this result. Again, the runs quoted in the April issue show that time was kept by a superheater 4–4–0 engine, *Racehorse*, on the 2 p.m. *ex*-Euston over the most difficult part of the whole journey—Carnforth to Shap summit—with the enormous load of 56 axles, or 390 tons, which I am certain that no other company in this country would even attempt to haul unpiloted up 13 continuous miles inclined mainly at 1 in 175 to 1 in 100, and a further 5½ at 1 in 147 to 1 in 75 (four at the latter figure) with only a 4–4–0 engine.

Such figures as these show that the superheater 4–4–0 "George the Fifth" and 4–6–0 "Prince of Wales" type locomotives on the London and North Western Railway stand in exactly the same relation to the "Precursor" and "Experiment" types which preceded them as the large and powerful 4–4–2 and 4–6–0 types, which my correspondent specially mentioned in his previous letter, stood in relation to existing 4–4–0 types on the lines in question. It is perfectly evident, as already shown, that these superheater London and North Western engines can not only cope easily with the hardest schedules in force on that system, but have also an astonishing reserve of power with which to meet extremes of load and lost time. Of course, they are not infallible, any more than is the most powerful locomotive ever constructed. For example, a friend recently sent me a log of a run on which a superheater 4–4–0 lost 7 min., or 5 min. net, between Euston and Stafford on the 5.30 p.m. *ex*-Euston. As the load totalled a modest 400 tons, however, and a side gale was blowing throughout the journey, with rainstorms at intervals, this seems a rather creditable than discreditable failure on a schedule of 142 min. for the 133½ miles. I have had a similar experience on the 10.30 a.m. *ex*-Euston, but these are exceptions. All things considered, therefore, I still adhere to the remark made with regard to the new 4-cylinder 4–6–0, *Sir Gilbert Claughton*, which I think is justified by the foregoing illustrations.

My obvious duty now, of course, is to follow on with some details of what the engine in question is doing in the way of performance. If we were to believe all that the daily Press endeavoured to persuade us at the time of the recent Royal visit to Crewe, the new behemoths would be a class entirely apart in the matter of their astounding achievements. The notes which follow are not record feats of journalistic imagination, however, but of actual running. No. 2222 has recently been working daily either the 5.19 p.m. from Crewe to Carlisle (2 p.m. *ex*-Euston), or the 6.40 p.m. from Preston to Carlisle, both of which trains, it will be remembered, figured largely in the tables given in the February and April issues descriptive of running over Shap summit. Consequently it was with no small amount of interest that I proceeded to Crewe on the first day on which *Sir Gilbert Claughton* was diagrammed to work the 5.19 p.m. express, in order to obtain a record of his work. My chief misfortune lay in the disappointingly punctual start of the train, and also in the matter of load, which was at the minimum, although even the minimum is quite heavy enough, one would think, for the road to be traversed. The engine, therefore, had but little opportunity of displaying his powers.

From Crewe we had a load of 54 axles, or 375 tons, and made a moderate start, passing Minshull Vernon, 5 miles, in 8 min. 10 sec., and Hartford, 11¾ miles, in 14 min. 40 sec., at 70·3 miles per hour. A decided slack was made at Weaver Junction, after which we accelerated to 73·8 miles per hour at Preston Brook, passing that point, 19 miles from the start, in 21 min. 10 sec. Warrington, 24¼ miles from the start, was passed at reduced speed in 25 min. 50 sec.—an improvement of 1 min. 20 sec. on my previous best with this train. The 11¾ miles on to Wigan, largely on rising grades, took 12 min. 25 sec., giving a total of 38¼ min. for the 36 miles—1¾ min. under schedule time. On Boar's Head bank speed fell only to 44·6 miles per hour up the 1 in 100, until near the summit, when, probably owing to premature notching up, a further fall to 40·9 was registered. The 5½ miles from Wigan up to Coppull took 7 min. 40 sec. Descending the north side incline, speed rose to 72·5 miles per hour before a very careful slack was made for Euxton Junction, beyond which the running was most moderate, yielding a total time of 56 min. 20 sec. for the 51 miles from Crewe to Preston,

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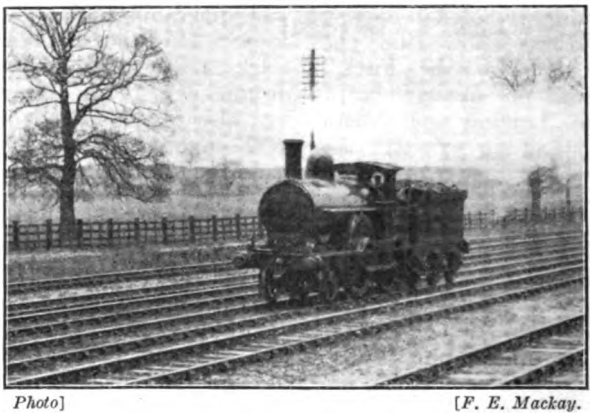
against 59 min. booked. The arrival was before time, so that the driver had done all that could be expected of him—the time certainly showed an improvement of 3 min. on my previous best with this train, although I have done better with the 1.12 p.m. *ex*-Crewe and a load but little lighter.

Beyond Preston, however, some significant feats were performed. With the load reduced to 44 axles, or 310 tons, I secured the fastest time to Barton that I have yet recorded—7 min. 40 sec. for the 4¾ miles, rising mostly at 1 in 500. At Brock troughs we were doing 68·1 miles per hour, and accelerated gradually up the faintly rising 1 in 1,060 beyond to a maximum of 70·3 miles per hour at Galgate. This station, 16⅝ miles from Preston, was passed in 18¼ min., and we should have been through Lancaster comfortably in 22 min. but for a very severe permanent way check, which commenced near the engine sheds, and continued with increasing severity through the station, and right over the Lune bridge beyond. Thus it took 23 min. 10 sec. to pass Lancaster, 21 miles—even yet a slight improvement on my previous best with the 2 p.m. down—but the check afforded exactly the opportunity required to show what the engine could do. Accelerating rapidly along the level, we passed Carnforth, less than 6 miles from the termination of the slack, at 68·1 miles per hour in 31 min. 10 sec. from Preston (27¼ miles).



Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY.

The Pilot in advance of the Royal train.

My next record to be broken was that from Carnforth to Oxenholme. The time of 12 min. 38 sec. for this 12⅞ miles, obtained in a correspondent's run given in the April issue, was made with a lighter load, and assisted by fast running between Lancaster and Carnforth, while the 12 min. 59 sec. time mentioned in the same article was achieved with an exceptionally high speed through Carnforth, although with a slightly heavier load. After slacking through Lancaster as described, and thus losing the impetus of the sharp down grade at this point, we yet achieved the excellent time of 12 min. 50 sec. from Carnforth to Oxenholme—30 sec. faster than my previous best with any train. Up the 1 in 131 bank beyond Carnforth our minimum speed was 57 miles per hour, while the brief descent beyond to Milnthorpe raised it to 69·2 miles per hour. On passing Oxenholme, after going 2½ miles up at 1 in 175, one at 103, one at 400, and one at 109, the speed had only fallen to 50 miles per hour. By Oxenholme, therefore, the whole of the lost time due to the Lancaster slack had been regained, and we passed this point "dead on time," the 40⅛ miles from Preston having occupied exactly 44 min.

From Oxenholme to Grayrigg, 7 miles beginning with 2½ at 1 in 182, 105 and 120, continuing with 2½ at 133, and finishing with 2 at 100, our time was 10 min. 40 sec.—average 39·4 miles per hour, and the best time I have yet seen with any load over 280 tons. Our lowest speed on the incline was 33·1 miles per hour. Time was now well in hand, and at this point the real interest of the run ceased, as no attempt was made to diverge further from the working times. The 6 miles from Grayrigg to Tebay occupied 6¾ min., with a maximum speed of 64·3 miles per hour at the troughs. Speed was then allowed to fall on the 1 in 75 of Shap incline to a minimum of 23·1 miles per hour, causing the 5⅝ miles from Tebay to Summit to take 10 min. 5 sec. With 20 sec. in hand, the most cautious running to Penrith ensued, with many slacks for curves, and no speed higher than 70 miles per hour. 14 min. 10 sec. being taken to cover the 13½ miles from Shap summit. Beyond Penrith the running smartened up a little, a top speed of 79 miles per hour being registered near Calthwaite, but further slacks, culminating in a dead slow check for signals at Upperby Bridge, caused the last 17¾ miles from Penrith to Carlisle to

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take 18 min. 25 sec. This gave a total time of 104 min. 5 sec. from Preston—exactly as booked—but the Lancaster check and the signal check accounted for quite 5 min. of this, leaving a net time of 99 min. for the 90 miles. Therefore this was in no sense a phenomenal run, as the occasion did not warrant the putting forth of any special effort, but it exhibited certain very significant features. I am hoping in the near future to secure a collection of records of the work of this class with the heavy summer trains, which will afford a striking comparison with the work of the existing superheater types already described.

The correspondent who kindly furnished me with logs of the five runs over Shap summit—which I compared with my own in the April issue—has now forwarded to me details of the journey behind *Cyprus*, on the 6.40 p.m. *ex*-Preston. With 280 tons behind the tender, the engine accelerated to 47·4 miles per hour up the 1 in 135 from Carnforth start, actually passing Milnthorpe, 7¼ miles, in 9 min. 39 sec., and reaching Oxenholme, 12⅞ miles, in 16 min. 27 sec. The acceleration from Oxenholme start up Grayrigg bank, however, constituted the feature of the run. Starting on the 1 in 182, and continuing up single miles in succession at 1 in 105 and 1 in 120, the average speeds over the next four miles, two at 1 in 133, followed by two at 1 in 100, were 40·4, 42·4, 42·4, and 41·9 miles per hour respectively. Curiously enough, on my own run on the same train with *Cyprus*, we reached the same speed of 42·4 miles per hour on the 1 in 133, but fell back to 37·5 on the 1 in 100; while this wonderful effort also beats my experience with *Defiance*, whose minimum at Grayrigg summit, with 10 tons less, was 39·5 miles per hour.

Before leaving this topic, there is another remark made in a recent issue which might at the present time lay me open to a charge of inaccuracy. It was that, since the introduction of the superheater engines, piloting over Shap summit had become "a thing of the past." Curiously enough, the last few weeks seem to have witnessed—for some reason with which I am unacquainted—a partial withdrawal of superheater locomotives from the Preston and Carlisle section, together with a recrudescence of the old "Jumbo" and "Experiment" arrangements which were so long in force. It is, I admit, only on the rarest occasions that I have seen superheater engines piloted; in fact, only with loads of 58 axles or over to or from Carlisle, except in instances where the pilot has been working "home." I do not think the most captious critic could take exception to the provision of a pilot in examples like these, over a road which includes such continuous grades as 4 miles at 1 in 75, and 13 miles at 1 in 100 to 182 in one direction, or 6¼ miles at 1 in 125 and 11¼ at 1 in 132 to 229 in the other! The "Experiment" engines need pilots over the summit for considerably less loads than these, although I have known instances where they have unaided taken up to 50 axles on important expresses. The general question of piloting, its causes and its effects, will, however, form one of my subjects in the near future, and I need not therefore now pursue the topic further.

This reappearance of piloted "Experiments" at Carlisle led indirectly to my obtaining a couple of noteworthy runs in a different direction altogether. I have been endeavouring lately to collect "superheater" runs by south-bound expresses from Carlisle—both Midland and London and North Western—in order to supplement a fairly extensive collection of non-superheater runs in the same direction, prior to dealing with those routes in these columns. Arriving at Carlisle on a recent Friday at midday, and having to reach the North-East Coast by night, without being particular by what circuitous route I travelled, I was prepared to take either the 12.5 p.m. Midland express to Leeds, the 12.18 p.m. London and North Western express to Crewe, or the 12.38 p.m. of the same company to Preston—each one a heavy, fast, and important train. As luck would have it, the first-named train was hauled by two Midland 6 ft. 6 in. "rebuilds," the first portion of the 12.18 by an "Experiment" and the second by an "Experiment" and a "Jumbo," and the 12.38 by a similar combination. Despairing, therefore, of achieving my object, I joined instead the 12.40 p.m. Caledonian express to go northward to Carstairs, intending to return by the express due back in Carlisle at 4.5 p.m. (the 2 p.m. *ex*-Edinburgh), and the venture was well rewarded.

The journeys furnish a decided contrast to those already mentioned, especially in view of the quotations with which this article opened, as the engines employed were in both cases of the moderate-powered intermediate 4-4-0 or enlarged "Dunalastair" type. On the down train we had No. 901, with a miscellaneous load of three Lancashire and Yorkshire, one Caledonian,

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and two West Coast corridor coaches, plus a twelve-wheeled West Coast dining car —total 220 tons. The usual brisk "Caley" start to Gretna was made, this initial 8⅝ miles taking 11 min. 25 sec. with a maximum just exceeding a mile-a-minute over the Solway bridge. Up the 7½ miles at 1 in 193-200 past Kirkpatrick our minimum was 45 miles per hour, and the same figure was repeated on the final 4¼ miles at 1 in 200-203 to Brackenhill summit. Thus the 8⅛ miles from Gretna to Kirtlebridge took 10 min. 40 sec., and the subsequent 9 miles to Lockerbie 10 min. 25 sec. Beyond Lockerbie, on the 5 miles down at 1 in 528 which succeed the short 1½-miles drop at 1 in 200, a top speed of 68·1 miles per hour was touched, while a rate of 66·2 miles per hour was sustained for some distance beyond. Thus the 8¾ miles from Lockerbie to Wamphray were covered in 8 min. 20 sec., and the last 5¼ miles up to Beattock station were completed smartly in 6 min., giving a total time of 46 min. 50 sec. for the 39¾ miles from Carlisle. This showed an excess of 50 sec. on schedule time, but was amply atoned for on the subsequent stage.

Attaching a 0–4–4 tank engine in rear, a surprisingly rapid start was made up the famous bank, an acceleration to 38·9 miles per hour being recorded on an average grade of from 1 in 70 to 1 in 88. On the very steep 1 in 69 section near the summit, the speed fell temporarily to 35·7 miles per hour; but the summit, 10 miles from Beattock, was passed in 17 min. 5 sec. from the start—the smartest climb I have ever yet recorded. This gave the driver several minutes in hand, so that a most moderate descent to Carstairs followed, no higher speed than 68·1 miles per hour being touched. The 8⅛ miles from summit box to Abington took 8 min. 25 sec.; the 9 miles thence to Symington 9 min. 5 sec., and the last 6⅛ miles to Carstairs stop 7 min. 50 sec. So the total time for the 33¼ miles from Beattock was 42 min. 25 sec., and indicated a gain of 1 min. on schedule time from Carlisle.

The more noteworthy run by far, however, was that which I secured on the return journey to Carlisle behind No. 889, an engine of the same type. I joined the 2 p.m. *ex*-Edinburgh at Symington, and it was made up there to the really substantial load for this class of engine, of 5 twelve-wheelers and 4 eight-wheelers, or 315 tons in all. A good start is afforded from Symington down a brief 2½ miles at 1 in 184 to the Clyde bridge, over which length we accelerated to exactly 60 miles per hour, passing Abington, 9 miles, in 11 min. 50 sec. Some fine work was recorded up the continuous grades of 1 in 240 to 330, Elvanfoot, 5¼ miles further on, being passed in another 6 min. 35 sec. On the final 2¼ miles at 1 in 99, however, speed fell more rapidly to a minimum of 33·3 miles per hour, so that the 2⅞ miles from Elvanfoot to Summit box took 4 min. 20 sec. It was, however, a noteworthy achievement for No. 889 to breast the summit with 315 tons in 22¾ min. from Symington—a total distance of 17⅛ miles. On the descent to Beattock the pace was unusually cautious. No higher speed than 68 miles per hour was recorded, while for the major part of the distance it was more nearly 55 or 56 miles per hour. Thus the 10 miles from the summit down to Beattock consumed as much as 10 min. 40 sec.

Even on the subsequent 4 miles at 1 in 202 beyond Beattock the maximum was only

Photo] [*F. E. Mackay.*

LONDON AND NORTH WESTERN RAILWAY.
Up North Wales Express.
4–6–0 Locomotive No. 2626, *Chillington.*

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64·3 miles per hour, but after this matters began to improve. On the undulating stretch following to Lockerbie a higher maximum of 66·2 miles per hour was attained, the 14 miles from Beattock to Lockerbie being covered in 13½ min. The 5 miles at 1 in 528 and final 1¾ at 1 in 200 to Brackenhill summit only reduced our speed to a minimum of 48·4 miles per hour, and then a remarkable effort was made. Down the first 4¼ miles at 1 in 200–203 a maximum of 70·3 miles per hour was touched. This fell on the level stretch beyond to 64·3 miles per hour, but was succeeded on the final 7 miles of 1 in 193–200 to Gretna by the high maximum of 80·3 miles per hour--the first 80 record I have ever secured on the Caledonian Railway. The 5⅝ miles from Lockerbie to Ecclefechan occupied 6 min. 20 sec., after which the ensuing 11½ miles to Gretna were covered in 9 min. 55 sec., the 4½ miles thence to Rockcliffe in 3¾ min., and the last 4⅛ miles into Carlisle in 4 min. 50 sec. In this way the following times into Carlisle were secured:—from Lockerbie, 25¾ miles, 24 min. 50 sec.; from Beattock, 39¾ miles, 38 min. 20 sec.; from Beattock summit, 49¾ miles, 49 min.; and from Symington, 66⅞ miles, 71¾ min. The booking is one of 75 min., but with a slightly more rapid descent from Beattock summit, especially south of Beattock station, a net time of 70 min. or even less might with ease have been achieved. I consider this a particularly fine performance in respect of the type of engine employed.

A run with one of the larger 140 class of 4–4–0 engines, and a still heavier load, may with advantage be compared with the last-mentioned. The train in this case was the 10 a.m. *ex*-Glasgow, loaded to 5 twelve-wheelers (two dining cars and three Caledonian "Grampian Corridor" coaches), together with 6 eight-wheelers, the train of 54 axles weighing in all 380 tons. In view of the load, the services of an early 4–4–0, No. 90, were allowed as pilot to No. 143 as far as Beattock summit. The day was historic in that it was the occasion of the devastating downpour in the Eastern Counties of last summer, and we had rain throughout to Carlisle. A smart run was made from the Central station to Motherwell. This 13¼ miles, with its clear rise of 200 ft., occupied only 18 min. 20 sec. from start-to-stop. The 5½ miles from Motherwell start to Law Junction were covered in 12 min., and the 7¾ miles thence to Cleghorn in a further 12 min., each section being steeply inclined upwards at from 1 in 143 to 1 in 98. Carstairs, 16 miles from Motherwell, was passed at reduced speed in 27¼ min. Beyond Thankerton we were checked by signal, presumably on account of the late running of the Edinburgh portion in front, but we passed Symington, 6⅝ miles from Carstairs, in 8 min. 40 secs. ran from Symington to Abington, 9 miles, in 10 min. 25 sec.; Abington to Elvanfoot, 5¼ miles, in 6 min. 40 sec.; and Elvanfoot to a stop at the summit box, 2⅜ miles, in 4 min. 20 sec. This gave a total time of 57 min 20 sec. (55¼ min. net) for the 39¾ miles up from Motherwell, which include a clear change of level of over 770 ft. Here the pilot was detached.

On the descent to Beattock the speed varied from a maximum of 75 miles per hour to a minimum of 52·9 miles per hour (after a severe brake application), and was further severely reduced in consequence of permanent way operations near Greskine box. Thus it took 12 min. 5 sec. from the summit start to pass Beattock, 10 miles; but with further maxima of 73·8 miles per hour at the foot of the 1 in 202, and 70·3 near Nethercleugh, the 14 miles from Beattock to Lockerbie were covered in 12¾ min. The 5⅝ miles from Lockerbie to Ecclefechan on this occasion took 6 min. 10 sec. On the first descent past Kirtlebridge 70·3 miles per hour was the top speed touched, but this was substantially improved on by a maximum of 76·3 at Gretna. The 11½ miles from Ecclefechan to Gretna took 10 min. 50 sec., and the 4½ thence to Rockcliffe 3 min. 50 sec. A serious delay outside Carlisle, however, made the last 4⅛ miles take 5 min. 40 sec.; but even then the total time for the 49¾ miles from Beattock summit had been only 51 min. 20 sec., with this 380-ton coach load. The net time was about 49 min.; the gross time from Glasgow with the conditional stop at Motherwell (2 min. 10 sec.), the stop at Summit box (2¼ min.), signal checks at Thankerton and outside Carlisle, as well as the permanent way check on Beattock bank, was one of 2 hours 11 min. 25 sec., or 35 sec. under schedule—an excellent record with such a load.

The correspondent to whose query I replied in the April issue with regard to the work of the new Prussian 4–6–0 4-cylinder compound locomotives does not, according to a subsequent letter, seem to be altogether satisfied with the defence of British locomotive performance which I there offered. Limited space available does not permit me

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to go very fully into his second letter, but one or two of his contentions certainly call for an answer. He remarks "that the (Prussian) locomotive weighs 20 tons more than the North Western engines (*George the Fifth*) is quite correct, but it must be remembered that the extra weight requires additional power to propel it, thus nullifying in some measure the larger boiler, etc., to which the weight is due." This, to say the least, is a startling proposition. Arguing on the same basis, *The Great Bear* might be expected to exert the same drawbar pull as the *Rocket*, the excess tractive power of the former as compared with the latter being absorbed in pulling the difference in weight! On the contrary, the available tractive power of a locomotive should increase in a greater ratio than its increase in total weight, that is, if the design be satisfactory.

Weight suggests a more effective basis of comparison than those already applied. The London and North Western engine *Racehorse*, in run E of those quoted, hauled 427 tons up 1 in 100 at an average speed of 34·6 miles per hour, the weight including the tender of the engine, as my friend still seems desirous of doing. This is equivalent to hauling 7·11 times its own weight. The Prussian engine hauled 533 tons including tender up a similar grade at "from 34 to 38 miles per hour," but was only thus hauling 6·66 times its own weight, leaving thus a substantial advantage with the British engine, which I am not at all sure, by the way, had reached the limit of its powers. My correspondent again took exception to the figures concerning coal consumption, citing the statement of Herr Gölsdorf (Chief Mechanical Engineer of the Austrian State Railway) that on his line the evaporative value of 6 lbs. of steam to 1 lb. of coal is only realised under favourable circumstances, against the average of 8 lbs. with English coal. Taking, therefore, a proportion of $\frac{3}{4}$, the 53·8 lbs. per mile mentioned as the consumption of the Prussian compound is reduced to 40·3 lbs. The coal consumption of *Wild Duck*, a superheater 4–4–0 of the same type, was only 36 lbs. per mile on the exceptional run mentioned, showing the British engine again to better advantage. Finally my correspondent, traversing my contention that compounding involves the use of high working pressures, with correspondingly heavy boiler maintenance costs, gives examples of Continental engines in Bulgaria and Russia working at pressures as low as 170 and 156 lbs. per sq. in. He overlooks the fact, however, that no compound locomotive could perform any such work as that with which we have been dealing at pressures anything like so low as these.

In a subsequent letter, received at the moment of writing, my friend mentions

Photo] [*F. E. Mackay.*

CALEDONIAN RAILWAY.

2 p.m. Glasgow–London Express.

Locomotive No. 903, *Cardean* (now fitted with Schmidt superheater).

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in support of the compound principle the published feats of the pioneer 4-cylinder 4–4–2 de Glehn compound engines on the Paris-Orleans Railway, which exerted an average drawbar pull for 13 kilometres of 2⅓ tons, and maintained a speed of 69 to 70 miles per hour with 354 tons—on a grade not specified. In comparison with this the London and North Western engine *George the Fifth*, on its trial runs, exerted maximum starting efforts at the drawbar of 8½ and actually 12½ tons with 357 tons behind the tender, maintaining a pull of 3 to 4½ tons for ten miles, and averaging well over 2 tons pull for the whole journey in either direction. On the down journey the average speed, including station slacks, was over 60 miles per hour for the complete 158 miles, a rate being maintained over two long stretches, together totalling 50 miles, of well over 70 miles per hour. The French compound weighs 70 tons against the 60 of *George the Fifth*. Published maximum indicated horse-power of the French locomotive in question is given as 1,900, but I fail to grasp the significance of this figure in that the London and North Western engine, with a drawbar pull substantially greater, is only credited with a maximum i.h.p. of 1,229. My correspondent also cites other cases of coal consumption, as, for example, the 4–4–2 compounds of the Northern Railway of France, which are said to consume only 40 lbs. per mile of a mixture of slack, briquettes and small coal when hauling 400 tons. Against this, however, the 36 lbs. per mile of *Wild Duck* may again be quoted—with admittedly superior fuel, but maintaining a higher mean drawbar pull. On the Great Western Railway also I believe I am correct in saying that the average coal consumption of the 4–6–0 express engines, engaged on similar work, is rather under than over 30 lbs. per mile.

Returning, however, to the original argument, I do not consider there is any satisfactory basis of comparison between the work of two such very diverse types of engine as the Prussian compound and the London and North Western 4–4–0, their dimensions being so widely at variance. Similarly the statement on which the whole argument has been based, as to the performance of the Prussian engine, was couched in such vague terms as to afford but poor material for argument. My sentiments in this matter, however, have been rather strengthened by the receipt of a brief communication from a friend, who writes :—" As regards that Prussian locomotive, are you not tilting at a windmill ?

Photo] [*R. J. Purvis.*

NORTH EASTERN RAILWAY.

Up Scottish express (crossing King Edward Bridge, Newcastle), drawn by No. 825 (with Stumpf cylinders) and with dynamometer car attached.

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Photo] [*F. E. Mackay.*

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

Down *Southern Belle.* Recent Express Tank Engine No. 80 (Schmidt superheater).

Some time ago the new Bavarian locomotives were said to do 50 miles per hour up 1 in 200 with 400 tons. I have been a great deal in Bavaria. On the long 1 in 200 near Gemünden, with 400 tons, they regularly sink to 110–115 sec., even if running late. This indicates speeds of from 31·3 to 32·7 miles per hour—a considerable drop from the figures under discussion. I had noticed the same thing when travelling in Germany myself, but hesitated to quote my own figures, as my experience there is comparatively limited.

But the most illuminating sidelight on this argument is furnished by the remarks of Mr. Gresley, of the Great Northern Railway, at the recent discussion at the Institution of Mechanical Engineers. He remarked that the coal consumption of a new superheater engine, which had burned an average of 30 lbs. per mile during three months test running, went up to 40 lbs. as soon as the engine was put into regular service. Commenting on this the *Railway Engineer*, in its May issue, remarks: "Nothing is really more illusory than special test results. Cases are known where, with no difference other than the order of their number-plates, one locomotive during tests can be made to show 15 per cent. greater economy than its fellow in regular service." It is worthy of note, therefore, that all the performances of London and North Western locomotives, on which the whole discussion has been based, have been *regular service* runs, as also the coal consumption of *Wild Duck* on a specially noteworthy, although quite unpremeditated feat; whereas all my correspondent's figures have been those of running and fuel consumption under test, with which Continental locomotive engineers are so fond of regaling the scientific world. Under the circumstances, therefore, I think we are justified in entertaining no fears at least for the equality of British locomotive design with Continental.

Finally, as my first correspondent remarks in the letter with a reference to which this article opened, the true basis of comparison between locomotives is that obtained by reference to their consumption of steam, coal and water, their working and maintenance costs and mileage between repairs, in conjunction with the work performed. Were such figures more readily available in this country, we should be in a far better position to see how efficiency in performance is balanced by economy in practice.

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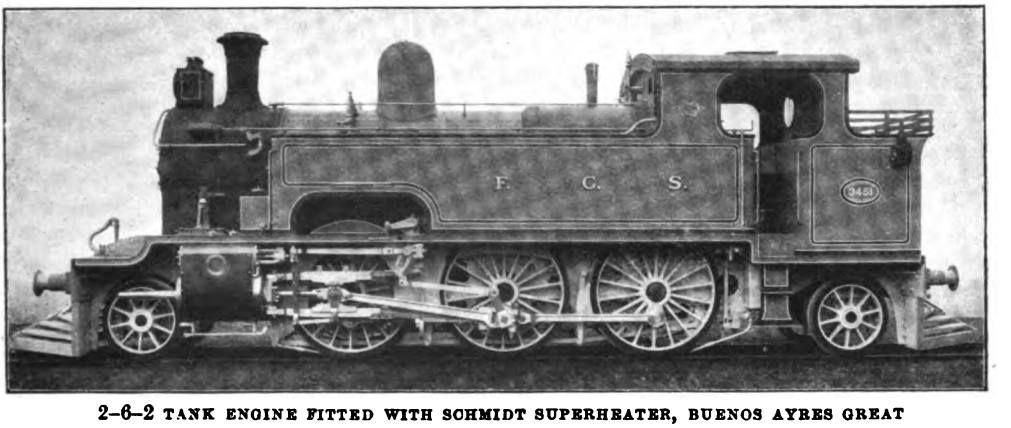
The Railways of Argentina. [No. I.]

REMARKABLE RECORD OF BRITISH ENTERPRISE.

ONE of the ablest and most comprehensive accounts of railway work ever embodied in a Consular report is that last presented by Mr. H. G. MacKie, His Majesty's representative at Buenos Ayres. It relates to the vast system of private and Government lines constructed in the Argentine Republic, which occupies the greater portion of the territory comprising the continent of South America lying to the south of Bolivia and Paraguay, with a total area variously calculated as between 1,139,700 and 1,886,200 square miles, and a population of seven millions and a quarter. British enterprise and skill are recognised in every branch of industry in which the inhabitants are engaged, and it is no exaggeration to say that the amount of British capital invested in the Republic already exceeds *five hundred millions sterling.* Of this enormous sum, considerably more than one-third has been devoted to railways, the first of which was completed in 1860. Twenty years later the mileage opened amounted to 1,536. In 1891 nearly 7,000 miles of track were in use, and more than 5,000 miles were under construction. In 1909, 16,000 miles of railway were open. 12,000 miles of which was the property of British Companies, possessing an aggregate capital of £170,000,000. The year 1911 showed a further increase, and at the present moment the total mileage of the railways of Argentina is not less than 18,000.

Argentina's magnificent network of communications that tap some of the richest pastoral zones in the world and traverse fertile lands of great agricultural wealth, will, as Mr. MacKie points out, remain to all time monuments of British enterprise and engineering skill. In both the economic and political conditions of the country these railways have, he states, worked a marvellous transformation, redeeming the entire land from obscurity, was affording the means of pacification and occupation of the vast territories comprised within the present limits of the Republic. It is not too much to say that the railways have carried civilisation into the heart of a country at one time oppressed by tyranny and political upheavals, and, by linking the provinces with the seat of government and great central market, have played an important part both in consolidating the National Federation, and producing the remarkable prosperity the country has now attained.



2–6–2 TANK ENGINE FITTED WITH SCHMIDT SUPERHEATER, BUENOS AYRES GREAT SOUTHERN RAILWAY.

Among the less ambitious schemes for the advancement of trans-continental communication, the linking up of the Argentine railway systems with those of Paraguay,

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Bolivia, Brazil, Uruguay and Chile is worthy of mention. The union of the Argentine narrow gauge system with the Paraguayan and Bolivian railways is being effected in the former case over the Santa Fé Railway, and in the latter over the Central Cordoba and Central Northern lines. This enterprise is being carried out on the initiative of a Franco-Belgian combination known as the Compañia General de Ferrocariles de Buenos Ayres, who are building 1,250 miles of railway. The Argentine Northern and Central Paraguayan Railways are forming a link between their systems, while the Central Railway is advancing northwards to meet the Brazilian extensions, as well as the Uruguayan lines, which will be reached at Salta by means of a ferry.* The Chilian coast is now being approached from three new quarters: (*a*) over the Great Southern system *viâ* Bahia Blanca and Neuquen to the Chilian port of Concepcion; (*b*) over the North Argentine Railway *viâ* Tinogasta to the port of Caldera; and (*c*) over the Central Northern Railway from Salta to Antofagasta. By means of these railways outlets will be created for the produce of the inland districts of Argentina, at present too far removed from the sea to be profitably opened up to commerce. Among the foreign enterprises that will have a detrimental bearing upon British railways in Argentina, the French broad gauge railway from Rosario to Puerto Belgrano, where extensive harbour works are in progress, will be the most formidable. It will enter into direct competition with the Great Southern Railway in the grain carrying trade.

According to the preliminary figures for 1911, issued by the Department of Railways, the railway system of the Republic covered 19,618 miles of completed line, extending from the Brazilian frontier on the north to about the 48° of south latitude, and from the Atlantic on the west across the Andes, forming a link with the Chilian railways by means of which Valparaiso on the Pacific Ocean is now reached. Of these 19,618 miles of railway, 16,288 miles belong to companies and 3,330 miles are the property of the State. Notwithstanding the present extensive mileage of railways the requirements of transport have not yet apparently ceased growing, and fresh capital continues to find its way into Argentine railway investments. In 1910 the new issues of capital sanctioned by the Government is returned at £10,800,000, and there are no less than 5,592 miles of track under construction to be thrown open to traffic within the next year or two. This rapid rate of progress might lead one to imagine that before long the sphere of activity of the numerous railways now in existence would overlap with the constant reduction in the radius of each agricultural area tapped by the various railway services, but the productiveness of the country continues to respond to the ever-increasing transport facilities.

No less than 88 per cent. of the capital invested in railways has been derived from foreign sources, principally British—the Government being represented to the extent of only 12 per cent. Although France and Belgium have secured a footing in Argentine railway enterprise, the amount of their invested capital is only about £8,000,000. Excluding the Government railways the United Kingdom holds the giant's share of nine-tenths of the capital in the Argentine railway companies, which is computed at £194,500,000, and it might be added that practically the whole of the vast area of Argentina is served by five of the great British-owned railway systems, which have an aggregate length of 12,070 miles.

The following figures have been extracted from the preliminary return issued by the Department of Railways for the year 1911:

*A vast petroleum field has recently been discovered at Salta.—Ed. R.M.

Railways.	Capital.	Passengers.	Goods.	Receipts.	Expenses.
Buenos Ayres—	£		Tons.	£	£
Great Southern	43,829,400	23,054,800	7,548,000	4,941,600	2,886,200
Pacific	45,175,800	8,965,000	4,716,900	4,891,600	2,842,700
Western	20,435,800	9,507,300	4,030,900	2,694,400	1,086,000
Central Argentine	39,463,000	16,617,800	6,839,800	5,160,200	2,902,600
Central Cordoba	15,228,500	1,825,800	4,185,100	1,567,800	1,035,500
Total	164,132,500	59,970,700	27,320,700	19,255,600	10,753,000
State Railways	18,264,200	1,738,700	2,113,400	1,226,200	1,165,900
Other Companies	34,403,500	2,692,700	4,074,500	2,972,400	2,329,100
Grand Total..	216,800,200	64,402,100	33,508,600	23,454,200	14,248,000

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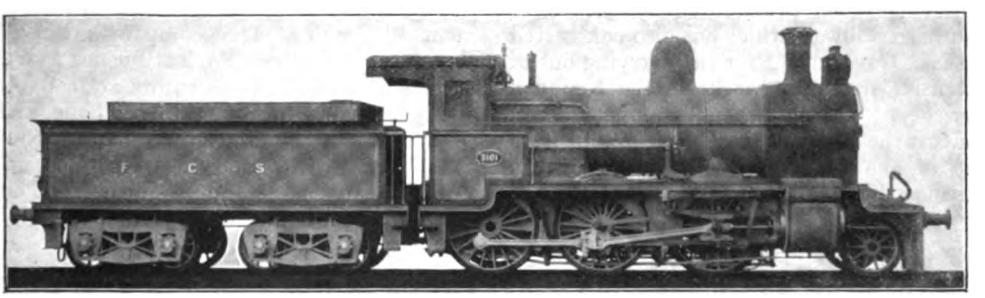
Control over British railways in Argentina is exercised by boards of directors in London. Actual administration and working is vested in the general managers, who, like the heads of departments, are generally British. The legal status of the companies in the country is exercised by local committees, whose members are mostly Argentines. These committees are practically branches of the London boards, and deal with matters of policy, relations with the Government, etc. The working *personnel* is composed of men of several nationalities—the labourers employed on construction works being usually Italian.

Great Southern Railway.

The Great Southern Railway is one of the most important lines in South America. As its name implies, the system of this railway embraces the districts lying to the south of Buenos Ayres. It touches at various points along the 500 miles of coast line between the capital and Bahia Blanca—notably at La Plata, Mar del Plata, Necochea and the military harbour at Puerto Militar—and extends, in a westerly direction, from Bahia Blanca to the national territory of Neuquen, a distance of 347 miles. This latter line is being extended to the Chilian frontier, in the region of the Andes, and will, in time, form a second connecting link, in conjunction with the Chilian railways, between the ports of the two great oceans. The total length of the main line and branches is 3,547 miles, built at an average cost of £5,252 per mile. New extensions, representing some 521 miles, are in course of construction or about to be started upon. The issued capital of the company is £48,981,530, and the average dividend paid for 45½ years has been 7·56 per cent. per annum. With the exception of some 250 miles of double track on approaching Buenos Ayres and other large centres, the line is single, with a gauge of 5 ft. 6 in. The entrance to Buenos Ayres is on a high level four-track viaduct, 3 miles long. Extensive renewals have in recent years been carried out to the permanent way, to withstand the growing traffic. The rails put into new works and renewals are of the 85 and 100 lbs. types, laid on quebracho wood and steel sleepers; 936 miles of track is ballasted with stone and shells, and the remainder with earth. The rolling stock consists of:—

	Number.
Engines of various types..	568
Passenger carriages, of the bogie pattern, including first and second class saloons, sleepers, restaurant and parlour cars, etc., lighted by electricity	659
Baggage wagons	282
Horse boxes for fine stock	27
Goods vehicles (with a carrying capacity of 280,000 tons)	12,000
Live-stock wagons (with a capacity of 20,000 cattle or 150,000 sheep) ..	1,279
Goods vans	333
Service vehicles	509
Total	15,657



2-6-0 TWO CYLINDER COMPOUND LOCOMOTIVE FITTED WITH SCHMIDT SUPERHEATER: BUENOS AYRES GREAT SOUTHERN RAILWAY.

The company has not confined itself merely to the construction of working of railways, but has given special attention to the welfare and development of the districts opened up by its services. Important summer resorts have been created by means of accelerated services at moderate fares, the fashionable seaside resort, Mar del Plata, being worthy of mention in this respect. The company owns, or has controlling interests in, docks and moles at Buenos Ayres (south bank of the Riachuelo River), La Plata and Bahia Blanca, with which three ports its rails connect direct. Two grain elevators erected at this latter port have a capacity of 26,000 tons, with berthing accommodation for eight vessels.

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4-6-2 LOCOMOTIVE FITTED WITH ROBINSON SUPERHEATER, CENTRAL ARGENTINE RAILWAY.

The handling capacity of these elevators is 3,000 tons per hour, and several instances of quick loading are quoted. A record was established on September 5, 1910, when a steamer at one of the elevators loaded 5,181 tons in 6 hours 20 min. Curiously enough, two years later—on September 5, 1912—a steamer left the same elevator mole with a cargo of 5,090 tons of grain, put on board in 7 hours. The greater portion of the capital invested in the Bahia Blanca waterworks has been contributed by the Great Southern Railway, which has also contracted with the Government for the carrying out of extensive irrigation works in the Neuquen territory. These, when complete, will convert the valley of the Rio Negro, hitherto one of the least productive, into one of the most fertile regions in the country.

Central Argentine Railway.

The Central Argentine Railway has now some 3,000 miles of line running through the wonderfully fertile agricultural lands in the northern portion of the province of Buenos Ayres, the provinces of Santa Fé, Cordoba, Santiago del Estero and Tucuman. A large terminal station is being constructed at Buenos Ayres, and the electrification of the suburban sections of the line is in hand. The doubling of the track between Buenos Ayres and Rosario, a distance of 190 miles, is nearly completed, bringing the total length of dual track to 200 miles. From Buenos Ayres a service of trains is run to the Bolivian frontier, over the Central Argentine Railway, as far as Tucuman (720 miles), and thence by the narrow gauge railway, through Salta and Jujuy to La Quiaca on the frontier of that Republic. Like the other big railways the company owns wharves for the shipment of grain. The company's largest elevators adjoin Dock No. 2 at Buenos Ayres. Sixteen towers of the elevators are capable of lifting 2,432 tons of grain per hour, and the enormous buildings can store about 56,000 tons. The wharves are at Rosario, Villa Constitución and Campana. This company's rolling stock comprises :—

	Number.
Locomotives	588
Cars (accommodating 37,059 passengers)	587
Vans	135
Wagons (with a carrying capacity of 373,175 tons)	17,487
Service vehicles	737

For the opening up of fresh zones, as well as for the protection of the territories served by the Central Argentine Railway

Name of Branch.	Total Length.	Open to Traffic.	Additional.		To be Opened to Traffic.
			Rails Laid.	Earth-works.	
	Miles.	Miles.	Miles.	Miles.	
Las Rosas–Villa Maria	100¾	56	10¼	44¼	44¾ miles by sections
Las Rosas–Villa del Rosario	128	88¾	39¼	39¼	39¼ miles in 1912
Cruz–Cordoba	217	127	58	73	90 miles by sections
Cañada de Gomez–South West	18½	18½	—	—	Open
Santa Fé–Port	4¾	4¾	—	—	,,
Carmen–North West	46½	46½	—	—	,,
El Chanar–Burruyacu	9¾	9¾	—	—	,,
Rio Cuarto–Salto	78	—	53½	60½	By sections
James Craik–Villa del Rosario	46	—	—	—	Plans not yet approved
Maria Juana–Matilde	53¼	—	53¼	53¼	Open to goods traffic
Despañaderos–San José	9½	—	—	4⅓	In hand

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system against foreign competition, concessions for numerous extensions and branches of the approximate aggregate length of no less than 1,393 miles have been obtained by the company from Congress. These extensions are to be completed within a period of 10 years. The table on page 470 shows the company's new lines opened to July 31, 1912.

The gross receipts are the highest in the history of the railway, and have created a record in railway working in this company. A special train service has been inaugurated between Buenos Ayres and Rosario, the journey being made in under five hours, thus enabling merchants to make the round trip between these points, and to settle business matters within the day. It is anticipated when the doubling of the track between these points is completed, the time will be further reduced.

Central Cordoba Railway.

The system known as the Central Cordoba Railway comprises six different sections, which previously formed five separate companies. These sections are as follow:—Eastern Section, Central Northern Section, North-West Argentine Extension, Rafaela Steam Tramway, Cordoba and Rosario Railway, and Cordoba Central Buenos Ayres Extension. The Eastern Section covers a distance of 130 miles from Alta Cordoba station (city of Cordoba) to the flourishing town of San Francisco, situate on the eastern boundary of the province of Cordoba, where it connects with the Cordoba and Rosario Railway, the Central Argentine and Santa Fé Railways, joining in Cordoba with the Northern Argentine Railway and Central Northern Section. There are quite a number of thriving industries established all along the line, such as flour mills, lime kilns, charcoal industries and saw mills—where most of the wood blocks used in paving the streets of Buenos Ayres, Rosario, Cordoba, and Tucuman, are made. Besides these products, the line transports cereals and goods in transit from north to south and *vice versa*.

Central Northern Section was formerly the Central Northern Railway Company, with branches to Chumbicha and Santiago del Estero, built by the National Government in 1871, and sold to a company in 1887. Ownership of the line passed over to the Cordoba Central Railway in 1889. The main line of this section has a length of 338½ miles from the city of Cordoba to that of Tucuman, the branch line from Recreo to Chumbicha being 109 miles long, and the branch line from Frias to Santiago del Estero 100 miles. A third branch is in course of construction from the eighth mile of the main line to the mountainous region of Rio Ceballos, and a portion of this branch has already been opened to the public. This region, which is similar to that of Ascochinga, at Jesus Maria, is most beautiful, possessing a splendid climate and the purest water to be found in the province of Cordoba.

The section connects at Cordoba with the Eastern Section; at Dean Funes and Chumbicha with the Northern Argentine Railway, and at Tucuman with the Central Northern Government lines, these junctions serving the passenger and freight traffic in transit from the northern and western provinces to the coast and *vice versa*. It also transports the local products, which consist chiefly of firewood, charcoal, alfalfa, tobacco, timber, lime, stone and sugar, the last mentioned being the most important industry in the province of Tucuman. Valuable sugar mills at Bella Vista, San Felipe and Amelia are situate on the main line of this section, close to the city of Tucuman. There are also a number of stock-breeding enterprises established on the main line and branches, which the railway encourages by offering the greatest facilities for their development, such as issuing direct tariffs from the different places where the industries are situated to all stations on the system.

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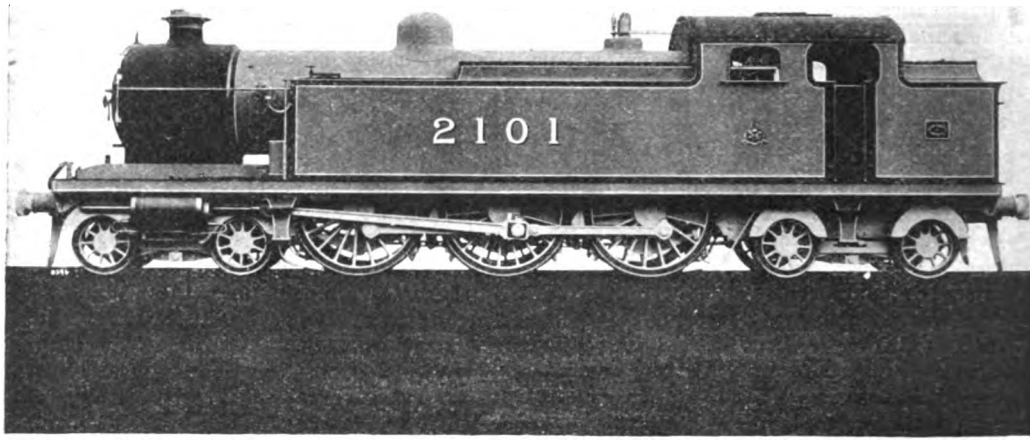
Midland Railway (London, Tilbury and Southend Section): New 4-6-4 Express Tank Engine, fitted with Schmidt Superheater.



Above is illustrated one of the new 4–6–4 superheater tank engines designed by Mr. R. H. Whitelegg for working the express traffic of the London, Tilbury and Southend Railway. As they were not delivered until after the absorption of the company by the Midland, they are numbered in the Midland list and painted their standard colours. Although the 4–6–4 type is used for a few narrow gauge engines in Ireland, these are the first main line standard gauge locomotives of the class introduced in Great Britain. The design is notable in view of its large dimensions, while the use of a Detroit sight-feed lubricator, instead of a mechanical lubricator, notwithstanding the introduction of a Schmidt high-degree superheater, and of Crosby safety valves, are also features of interest.

Leading dimensions are as follow: cylinders, 20 in. by 26 in.; coupled wheels, 6 ft. 3 in. diam.; bogie wheels, 3 ft. 1 in. diam.; coupled wheelbase, 13 ft. 10 in.; total wheelbase 38 ft. 10½ in.; distance between bogie centres, 32 ft. 4½ in.; length over buffers, 47 ft. 8 in.; diameter of boiler barrel, 5 ft.; length of boiler barrel, 14 ft 6½ in.; Length of firebox, 8 ft. 6 in.; steam pressure, 160 lb. per sq. in.; heating surface: tubes, 1,305 sq. ft.; heating surface: firebox, 141 sq. ft.; grate area, 25 sq. ft.; tank capacity, 2,200 gallons; coal capacity, 3 tons; weight in working order about 90 tons.

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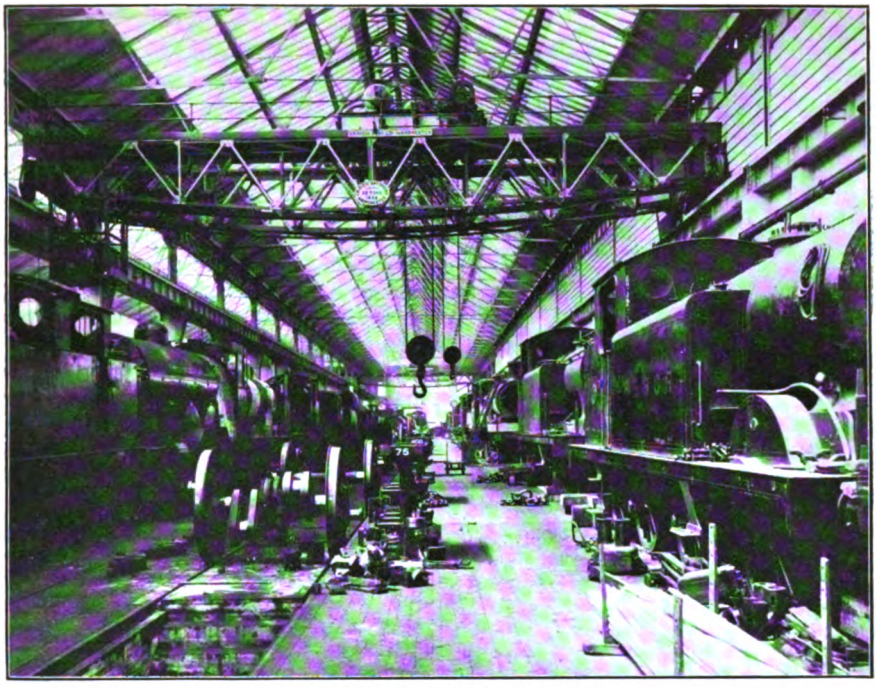

A VIEW IN THE ERECTING SHOP.

Brighton Locomotive Works:

LONDON, BRIGHTON AND SOUTH COAST RAILWAY.

By J. F. GAIRNS.

THE combination of a favourite seaside and holiday resort—perhaps the most famous on the south coast—an industrial centre, and the headquarters of the locomotive department of a great railway is unusual, and when it is borne in mind that Brighton is far removed from the principal manufacturing districts, and that the location of the London, Brighton and South Coast Railway's locomotive works there usually involves the carriage of materials and goods from the metropolis or beyond, the choice of site suggests itself as somewhat peculiar. Moreover, the works, as well as the Central station in Brighton, are situate on a plateau cut out of the hill side, at a considerable elevation above sea level—the floor level of the shops is about 130 ft. above ordnance datum—the chalk cliff rising on one side of the railway area, while on the other side the works overlook the industrial portion of the town. There is, therefore, no room for expansion, and enlargements effected in the past have had to be carried out in special ways. For example, the latest extensions of the shops are supported in columns, so as to extend over part of the low level goods yard, and in several instances buildings have upper and lower floors.

At an early date it was suggested that the works should be placed at Horley, a good central position, and one much nearer the metropolis. This proposal has been mooted again at various periods, together with other alternatives, but Brighton still remains the headquarters of the Locomotive Department. Some relief has been obtained by the recent removal of the Carriage and Wagon Department to new premises at Lancing. But in the space available for the Locomotive Works every square foot has had to be utilised in the best manner possible. Here a compact series of well-laid out and equipped shops are found, in some cases at upper and lower levels in view of the virtual impossibilities of lateral extension. Brighton is favourably located as regards the company's system as a centre for

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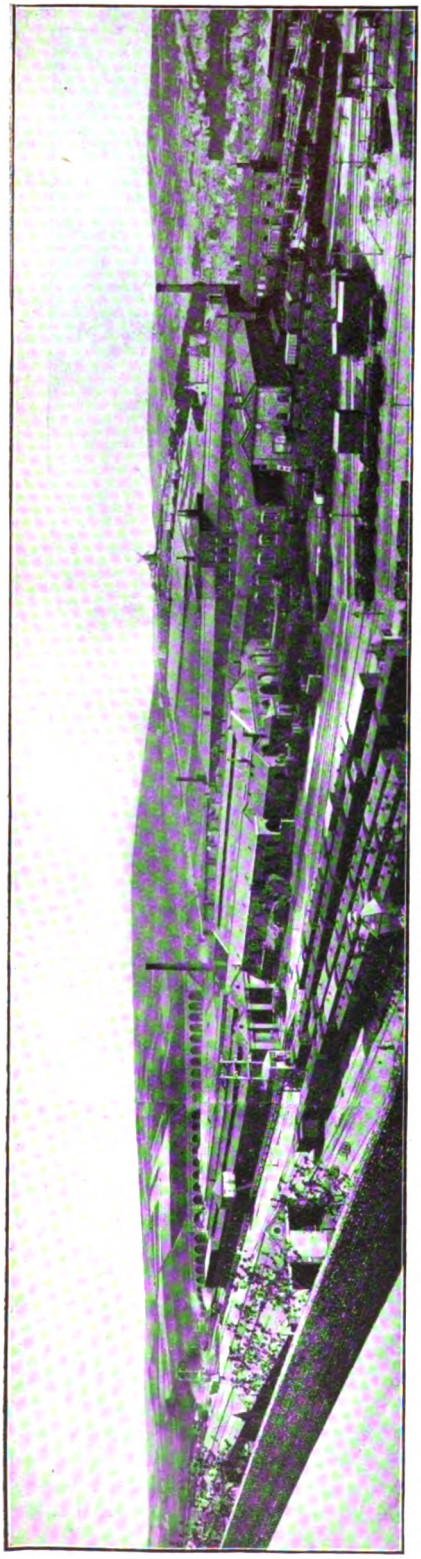

A VIEW OF BRIGHTON WORKS IN 1865.

locomotive construction and maintenance, the London engine sheds at Battersea and New Cross being the most distant.

In early days the "Brighton" works were little more than repair shops. In fact, it is doubtful whether they would have been located there had there been any anticipation of future extension on the scale which has since been realised. They have gradually developed, the principal impetus being the commencement of new locomotive construction at Brighton in 1852. Otherwise their growth has been due to the expansion of the Brighton system and the extension of the activities of the company. New construction was inaugurated by Mr. J. C. Craven, Locomotive Superintendent from 1847 to 1869, the first engine being a single-driver 2–2–2 tank engine for branch traffic. It had cylinders 13 in. by 20 in., 3 ft. 8 in. leading and trailing wheels, and 5 ft. 7 in. driving wheels. Weight in working order was about 25½ tons. A single-wheel express engine of "Jenny Lind" type was built in the same year. In succeeding years large numbers of engines were built at Brighton, and in Mr. Stroudley's time (February 1870 to December 1889) the works were largely rebuilt. Mr. R. J. Billinton (January 1890 to November 1904) made further extensions and Mr. D. Earle Marsh (February 1905 to August 1911) was responsible for considerable reorganisation, re-equipment and enlargement. Mr. L. B. Billinton, the present Locomotive Engineer (appointed in November 1911) is carrying out certain other changes which will further facilitate the work of the department. The total locomotive stock under Mr. Billinton's charge, involving repairs, maintenance, new boilers, and rebuilding as required, is 610 engines. About 1,300 men are regularly employed in the locomotive shops; the clerical staff comprises about 120, and nearly 1,000 are attached to the running department and the various running sheds and repair shops. Under Mr. A. H. Panter, Carriage and Wagon Superintendent, about 800 men are engaged, including those distributed about the system as well as the 300 or so at the new works at Lancing or still remaining at the old premises at Brighton. Mr. B. K. Field is Works Manager at Brighton Locomotive Works, and Mr. J. M. Jackson, Chief Draughtsman; Mr. J. J. Richardson is Chief of the Running Department, covering all engines in service and the running and outside shed staff; and Mr. W. P. Payne, one of the oldest members

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of the staff, Chief Clerk to Mr. Billinton.

The offices are placed immediately alongside the Central station, close to the end of No. 10 platform, and opposite the outer portions of Nos. 7, 6, 5, and 4 platforms. Near the gates by which access to this end of the works is obtained from a siding alongside No. 11 platform is a fire station and an inspectors' office. On the ground floor of the main building are the private rooms of the Works Manager and the Running Superintendent, each with a range of offices for their respective staffs. Above are rooms for Mr. Billinton and his chief clerk, with correspondence and general offices adjoining. At the end of this suite of rooms is a chemical laboratory under the direction of Mr. Matthewman. This is a new department, and is to be extended by building over the inspectors' office and fire station already referred to. Below there will be a reading room for the works foremen and other sub-chiefs.

The second floor consists mainly of the drawing office, where Mr. Jackson has a staff of fourteen draughtsmen. Large windows on either side, in combination with part roof lighting, render this a well-lighted and laid out department. Electricity is used for illumination, and Mr. Jackson has introduced an unusual and ingenious system of supporting the incandescent lamps whereby they can be placed in any position and at any height desired. A large motion model for investigating valve gear problems may be noted. At the end is a printing room and lavatories. The remainder of this floor is given over to the mileage and general offices.

There is a large open area between the office building and the wheelshop and stores building opposite. Originally a stores building was located here, but this has been removed and the space utilised for sidings and for storing boilers, castings, iron, and other items which can be placed in the open until required.

Adjoining is the main block containing the principal departments. The extreme length of this building is a little over 600 ft. and the width of the widest point nearly 450 ft., though the shape is approximately that of a truncated triangle owing to the conditions of space involved. The south end is glazed with obscured glass, so that the south light is well utilised, while skylights and side lighting realise very satisfactory results beyond. The large window expanse of the south end of this block of buildings is one of the notable features of these works. Next to the offices is the boiler shop stores, with weighbridge and racks for plates and other items required by this department. For lifting purposes a 6-ton overhead electric crane is provided. As in the case of many other cranes used at Brighton, especially the older and converted ones, the motors are controlled from the floor by means of hanging chains.

MR. LAWSON B. BILLINTON,
Locomotive Engineer, London, Brighton and South Coast Railway.

The boiler shop has an effective length of 505 ft. and for about half of this distance is 126 ft. wide. At the south end, built out as an extension from the glazed wall already referred to and similarly constructed, is an accumulator house for the hydraulic system. At this end of the shop proper is a transverse high roofed bay containing a rivetting tower, capable of taking work up to 30 ft. long, for rivetting boilers on end, with a Tweddell's hydraulic rivetter having a 17 ft. gap and giving pressures ranging from 25 tons to 100 tons. The work for the rivetter is handled by a 15-ton 3-motor electric travelling crane, and is operated by a controller of tramway type, placed conveniently so that the man in charge can adjust the work held by the

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crane with one hand and work the rivetter with the other. The wall crane for this has three jibs for handling plates. The bay also contains a set of large vertical rolls. An older rivetter serves for smaller work.

Each of the three longitudinal bays in the boiler shop is equipped with overhead cranes, and it is worthy of note that the supporting girders in the central bay extend some distance into the transverse bay so as to bring loads within the range of the transverse overhead crane previously referred to. In the west bay a set of horizontal plate levelling and straightening machines may first be noted. A series of marking off tables are placed near the south end, and distributed along this division on either side are various drills and plate edge planing machines so arranged that transfer from one to another is convenient. Among these machines may be noted specially a series of large radial drills, two-edge planers, and two duplex tube plate drills. The electric motors driving these are usually placed on platforms fixed to the columns supporting the roof. A 12-ton crane serves this bay as far as the transverse arcade.

The central bay is mainly used for boiler mounting. It is served by a 20-ton overhead electric crane. The east bay is given over to cab, tank and splasher construction, with an 8-ton overhead crane, and a few tools. Beyond the arcade in the west bay, devoted to detail work, may be noted a big duplex punching and shearing machine, direct driven, and a very useful machine, of which the staff speak highly, by Henry Pels & Co., for shearing and cropping angle iron sections. Further along is a division devoted to making smoke boxes and ashpans. Near the end, alongside the foreman's office, is a set of hydraulic accumulators served by motor-driven pumps.

The continuation of the central bay is used for rivetting copper fireboxes and erecting boilers ready to pass to the boiler mounting section of the same bay. Among the work in hand we noted the first Belpaire boiler for locomotive purpose built at Brighton, destined for the first of Mr. Billinton's 2-6-0 engines now under construction. At the further end of the division is a set of smith's fires as required for general and angle smith's work. At the end of the west bay is the big hydraulic press (210 tons) for pressing tube plates, throat plates, firebox sheets and the like. A large store of die blocks is placed alongside, with a coal furnace adjacent for heating the plates. A 12-ton overhead crane is provided for this division.

Proceeding back towards the transverse arcade in the boiler shop may be noted in

Maude & Co., [*Coventry.*

MR. B. K. FIELD,
Works Manager.

MR. J. J. RICHARDSON,
Outdoor Locomotive Superintendent.

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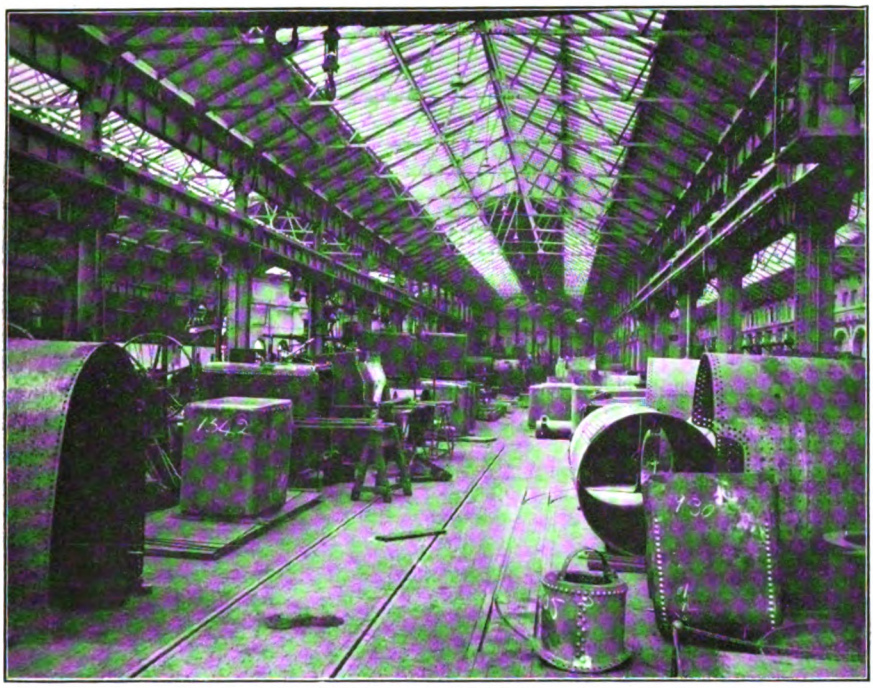
the east bay another Pels machine, a splitting shears for long plates, a punching and cropping machine, drills, a light edge planer for tank work, and against the wall two large "Sentinel" air compressors each driven by a 70 h.p. motor. The whole of the boiler shop is equipped with hydraulic rivetting plants where required, and with connections for portable pneumatic drills, caulkers, etc., for lighter work. At the extreme end of the boiler shop, under the tank house, is the steaming shed for steam tests. The boiler shop is well supplied with standard gauge railway tracks and with narrow gauge trolley lines as required, and the same may be said of all other divisions calling for such transportation conveniences.



THE BOILER SHOP (CENTRAL BAY).

The erecting shop is 593 ft. 6 in. long and 97 ft. 8 in. wide in two bays, each of the usual 3-line parallel type. Each bay has two 35-ton overhead electric cranes. Those in the east bay, 53 ft. 6 in. span, and those in the west bay, 40 ft. span. New engines are erected at the north ends of both bays, but the western section is chiefly given over to tank engines and tenders, bigger locomotives being dealt with in the east bay. In the former division we noted several of Mr. Billinton's new 0–6–0 tank engines under construction. Both divisions are fitted with hot water heating pipes above the benches and in the engine pits. Here, as in many other shops, lighting is effected by the high-pressure gas system, using incandescent mantles. In the erecting shop there is, of course, a usual equipment of pneumatic tools, portable cylinder boring machines, and the like. A notable feature, which also applies largely to other shops, is the systematic use of iron racks and trays for parts of fittings. There are employed owing to the lack of floor space for storing such items, but their use appears to us a decidedly commendable practice even where room is not so limited.

At the south end of the eastern bay is a switch cabin for receiving electric current from the Brighton Corporation electric supply system, and for distributing to the various divisions of the works. For ordinary shunting about the yards an unusual type of locomotive crane in employed. It is fitted with a bascule jib and operated electrically, the current being supplied from accumulators carried on the frame work behind the jib; the accumulators serving also as a balance weight.

Alongside the erecting shop and extending for a distance of 334 ft. 6 in. is the forge,

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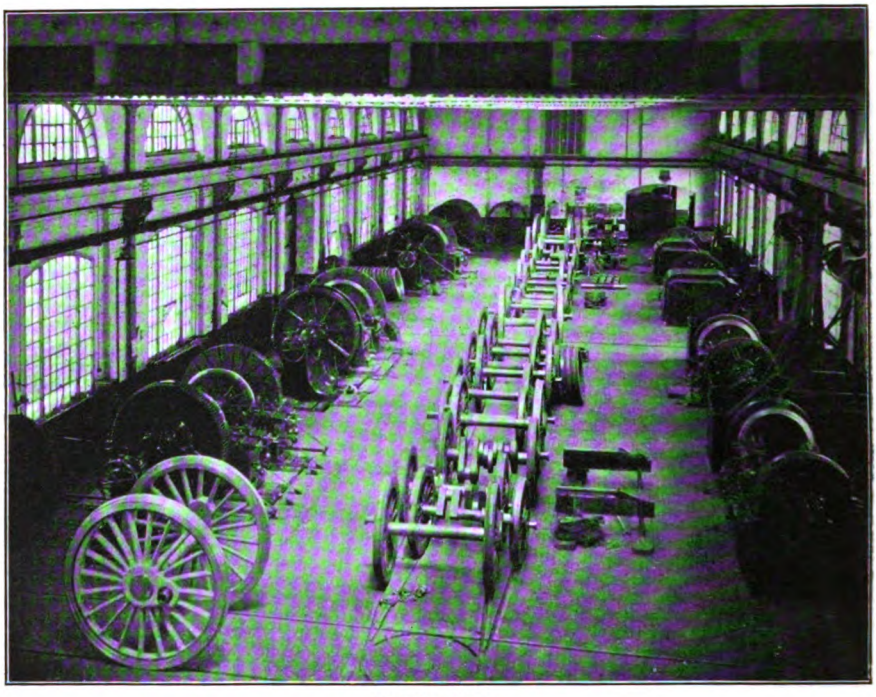
54 ft. wide. This opens into the smithy, and these two departments may be considered together in conjunction with other shops in the northern section. The frame shop, 183 ft. long and 47 ft. wide, really forms part of the same structure as the wheel shop, and its contiguity to the forge and smithy is due to the fact that the boiler, erecting and adjacent shops have been extended to its walls. An interesting feature of this building may here be noted. Originally only the central portion—comprising an entrance passage-way from New England Street, the ambulance station, Westinghouse brake room, and the patternmakers shop—was of present height; but a few years ago the roofs of the frame shop and wheel shop were raised bodily about 13 ft. and galleries constructed as upper stories. That in the frame shop is devoted on one side to Westinghouse brake repairs, gauges, and the like, and on the other side to general millwright's work, affecting the upkeep of machinery and appliances and light jobs for the carriage and wagon department.

On the Westinghouse brake side may be noted a brake testing frame. About midway along a telpher run-way is provided under the roof, extending right across from one gallery to the other. On this runs an electric carriage with lifting gear up to 15 cwt. and this enables parts and materials to be raised or lowered from or to the ground level. Collapsible gates protect the openings through the balustrades of the gallery.

In the wheel shop the gallery is used as a pattern store. A hatch on one side enables a hand crane to be used for lowering and raising patterns and goods to and from the ground level. The pattern shop itself is located in the central raised portion of this building. It has a usual equipment of woodworking machines, and a few others are placed in the adjoining gallery just referred to. The wheel shop has a 7-ton electric overhead crane operated from floor level. On one side may be noted six big motor-driven wheel lathes, and at the end two tyre drilling machines. On the other side is a quartering machine for crank pins, several smaller lathes, and a crank lathe. Opening out of this division is a small axle shop containing three straight axle lathes and a few other appliances. Outside the building is a wheel yard referred to later.



WHEEL SHOP.

In the frame shop may be noted a series of marking-off tables for engine frames,

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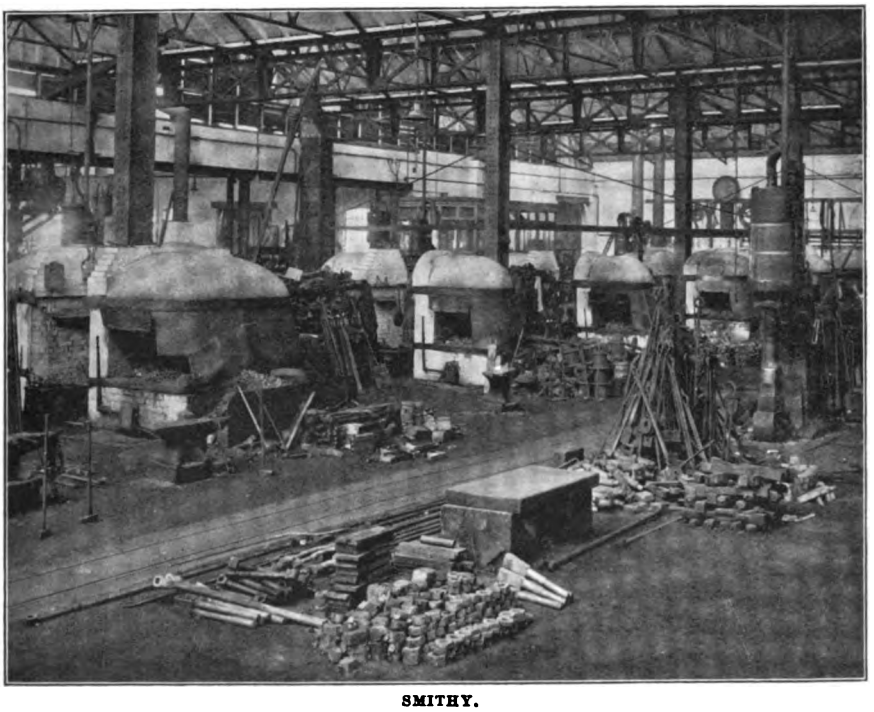
most of the remaining space being devoted to erecting carriage and wagon frames, which work is also covered by this department. A 10-ton overhead electric crane controlled from below is provided for lifting purposes. Otherwise the provision of pneumatic rivetters and a few other appliances suffices for this section. Beyond the transverse passage-way communicating with the frame machine shop is an enclosure which is to form the nucleus of an electric department for repairing and in due course building electric motors. Alongside is the frame machine and cylinder shop. In the former division, to which frames can be readily transferred after marking off in the frame shop, may be noted a series of machines for frame drilling and slotting. A big Hetherington machine with three heads and having a 42 ft. table now deals with heavy work, while a smaller and older machine with two heads serves lighter requirements. On the other side may be noted a series of ordinary and radial drills, and at the end a hydraulic press for forcing wheels on and off axles. This is fitted with a Schafer & Budenberg automatic apparatus for recording the pressures used throughout each operation. There are also a few lathes and slotting machines.

The cylinder shop is the first of those divisions which have been built out over the goods lines as already mentioned in introduction. Together with the iron store, spring shop and spring yard, it is carried on massive girders supported on pillars. This extension is about 430 ft. long and varies in width from 41 to 53 ft. At the south end the floor of the shop is 25 ft. 6 in. above the rails below and 21 ft. 6 in. at the north end. In the cylinder shop may be noted specifically two twin cylinder boring machines, a horizontal planer with arm extending into the valve chest of a cylinder for planing the valve faces and adapted also for milling the edges of the ports; an ordinary duplex planer; a large radial drill; a vertical slotter for port faces; and other usual tools for cylinder work.



SMITHY.

On leaving this section of the works by means of the passage-way between the frame and wheel shops one realises the peculiar location of the works more vividly than at any other place. Apparently on ground level one emerges on to a platform 44 ft. above street level, from which a magnificent view of the London Road viaduct and over the town is obtained. An inclined way and a flight of steps lead to a foot bridge carrying

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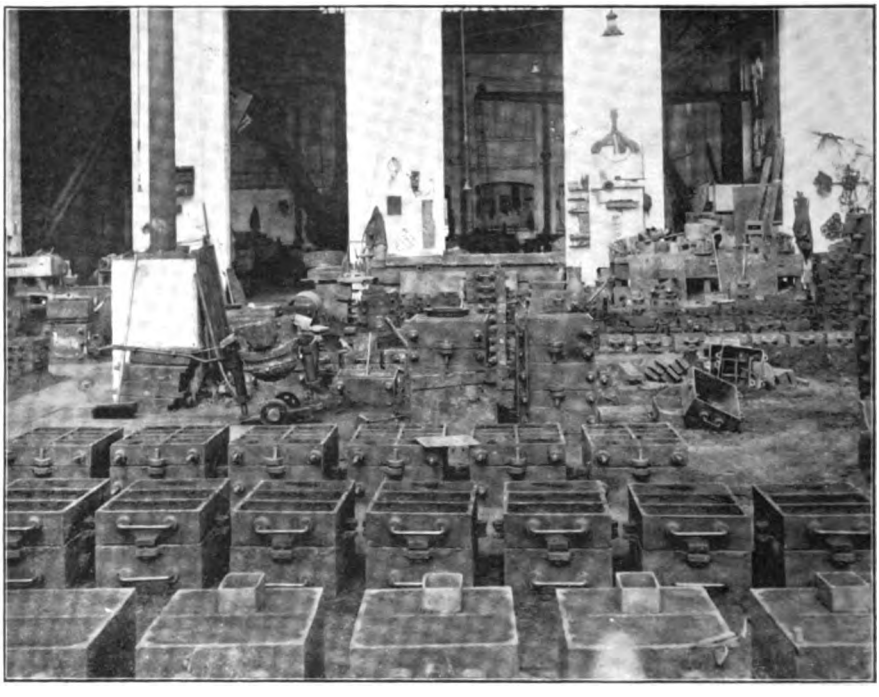
the time, pay and insurance offices, and steps connect therefrom with New England Street. On the lower level is a dining hall for workmen, adjoining which is a building containing on the lower floor a rifle range, while above is a workshop for the engineers' department. Next to the dining hall is a motor garage belonging to the company.

To the east of the wheel shop is a wheel yard with transverse rails connected by a central traverser. Adjacent are several departments at various levels. At the north end of the wheel yard a short flight of steps leads to a carpenters' and builders' shop, with drying and material stores below. From the south end of the wheel yard another flight of steps leads to what used to be an electric power station. This had for some years proved insufficient for the requirements of the works, so that current is now purchased for all requirements from the Brighton Corporation. The building now contains boilers supplying steam to two sets of duplex pumps in an adjoining room which supply hydraulic power to the goods yard, the accumulators being placed in a separate building a few yards away. An unusual feature, strongly exemplifying the premium upon space which exists at Brighton, is the book store adjoining the hydraulic engine house.

From the accumulator house we pass along the foundry yard, 10 ft. below the station level and 18 ft. 6 in. above the goods station, to reach the foundry building. At present this is undergoing partial reconstruction, but may be described as it will be when operations are completed. The new portion will provide a brass foundry alongside the existing fettling shop, 42 ft. 6 in. by 73 ft., with a sand blast room at one end of the latter and a series of crucibles in the former. A small stores building for patterns in use adjoins the brass foundry. The iron foundry is in two divisions, 78 ft. and 74 ft. 6 in. long. Its floor level is that of the foundry yard, so that a line of rails at station level serves for stacking pig iron at a convenient height for feeding the cupolas from outside. A central-jib hand crane in the centre of the larger division—the old foundry—enables castings and patterns to be manipulated. Here can be made the largest casting required. The newer sections deals with lighter work. At one side are the core ovens. Two cupolas, are sufficient to supply the iron foundry.



IRON FOUNDRY.

Returning to the main works we may either reach station level by a flight of

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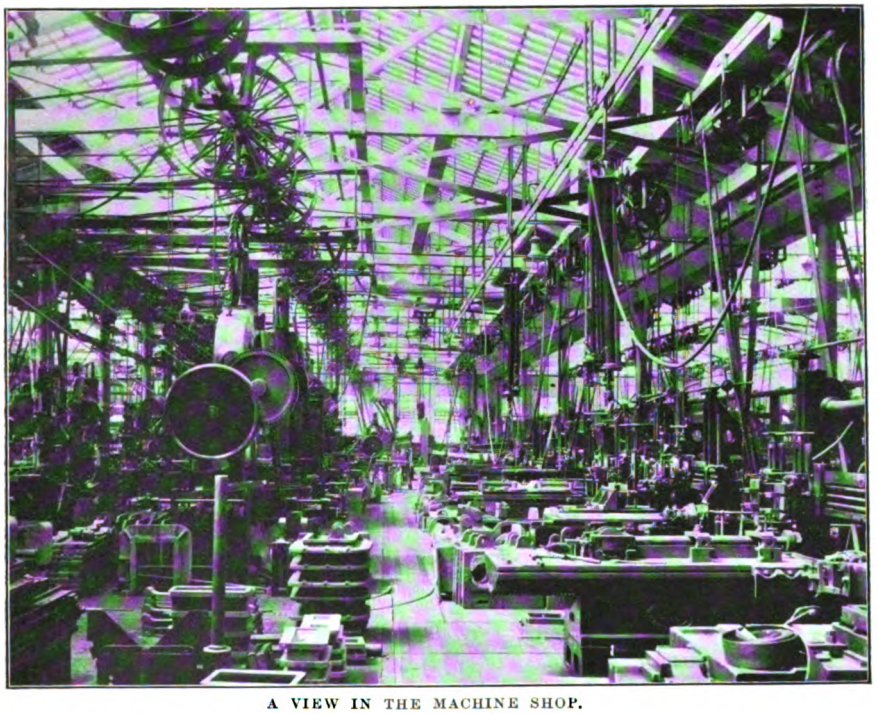
steps from the iron foundry or proceed along the foundry yard and pass round the new stores building to an inclined pathway rising alongside the wheel shop. The smithy and forge now call for attention. At the southern end are furnaces for shrinking tyres into wheels. Further along are two Belpaire locomotive-type boilers which supply steam to the big 4-ton steam hammer and to the drop hammers arranged against the wall. A reverberatory furnace heats the blooms and the gases from this pass into the fireboxes of the two boilers mentioned for raising steam. In the widened part, adjoining the end of the frame shop, are two more locomotive boilers, in use pending the completion of a new boiler house alongside. These boilers supply the smaller steam hammers—eight of 7½ cwts. and one of 15 cwts.—through underground conduits. In the smithy and forge together there are 26 hearths and 24 smith's fires, all fitted with downtake exhaust flues. At the south end is a large Sturtevant fan driven by a 30 h.p. electric motor for exhausting, while at the north end is a similar fan (70 h.p. motor) for the same purpose and a Sirocco fan (30 h.p. motor) for providing air blast for the forge furnaces, driven by separate motors carried on platforms attached to the wall of the chimney shaft. A separate furnace is provided for the 15 cwt. hammer.

The drop stamp battery is of the usual Brett type, with three heads, 25, 15 and 12 cwt. respectively. A separate furnace alongside serves the drop stamps. At Brighton, as at many other locomotive shops, drop stamping is an important feature, and much work of a relatively heavy character is forged in this manner. In fact the range of the work done extends from about ¼ to 285 lbs. A special device is used by which fins are removed under the hammers, so that the stampings are usually ready for immediate use without machining or other finishing off unless this is necessary for other reasons. To the east of the smithy is the iron store with the spring shop adjoining. These are carried over the goods lines as already mentioned. The principle of lay out is that steel enters from the store and leaves as a finished product. At the south end are benches for the die sinkers and for making dies for the drop stamps and hammers. We then come to a series of machines in order. The first cuts the steel blades to length, and the others slot, knib, spear and shear. Then comes a drilling machine for making necessary holes and a scragging machine tests the temper. A Buckton



A VIEW IN THE MACHINE SHOP.

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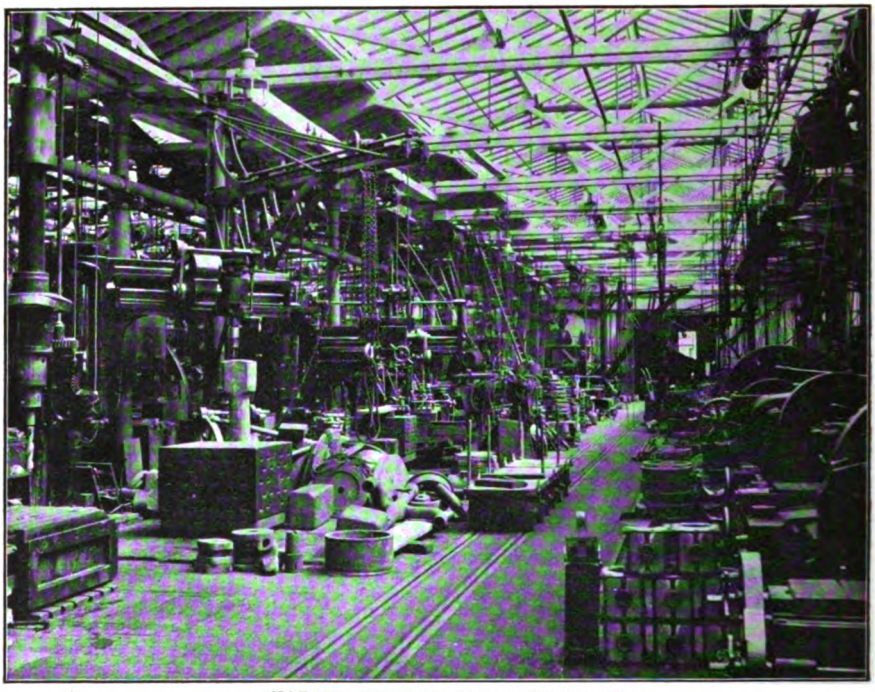
weight-testing machine gives a maximum pressure of about 12 tons. There are also machines for forcing buckles and wedge plates on to and into nests of leaf springs. Oil tempering is usual in this department. Mention may also be made of two Horsfall bolt forging machines, a Ryder hammer for forging nuts, etc., and a cold saw for cutting steel bars. Adjoining the spring yard is a casehardening department. At the north end of the forge is a machine shop stores, and parallel with this, at the end of the smithy, is a space alongside the main chimney shaft now used as a grindery. Here are three grindstones, one face grinder and several emery wheels. This shop used to accommodate an old beam engine working the pumps by which the water supply for the works is obtained from a well extending 175 ft. below. A pump room is now placed under the floor, two sets of three-throw pumps being driven alternatively or together by a 70 h.p. electric motor through Morse chains.

The machine shop is a fine erection, 207 ft. 6 in. long and 140 ft. 6 in. wide. There are five bays. The westernmost is devoted at the south end to fitting up connecting and coupling rods. Further along, axle boxes, brake work, regulators, valves and motion erecting are dealt with. A transverse division at the north end accommodates a quadrant grinder, a slot link grinder, lapping out machines, an overhung milling machine, a vertical milling machine, and a large Hetherington traversing machine for milling coupling rods, etc. The next bay contains along one side a large vertical drill, several ordinary and radial drills, a four-head multiple drill, a band saw for metal, a duplex boring machine and a facing and boring machine. On the other side may be noted a thread milling machine, and various lathes, some of ordinary types, others of turret and capstan design. One of the larger lathes has a cone-drive, instead of the usual geared headstock. In the third bay may be noted a German slot-milling machine for cutting keyways quickly, an old double acting machine for cutting keyways, a special vertical borer for making piston rings and adapted for machining both sides at once, and various other drilling, slotting and boring machines. The fourth bay contains mainly planing and shaping machines. In addition to the usual designs may be mentioned an old duplex two-head long-table planer, a large slotter, a slotting machine fitted with a radius attachment for machining radius links, a high-speed



ANOTHER VIEW IN THE MACHINE SHOP.

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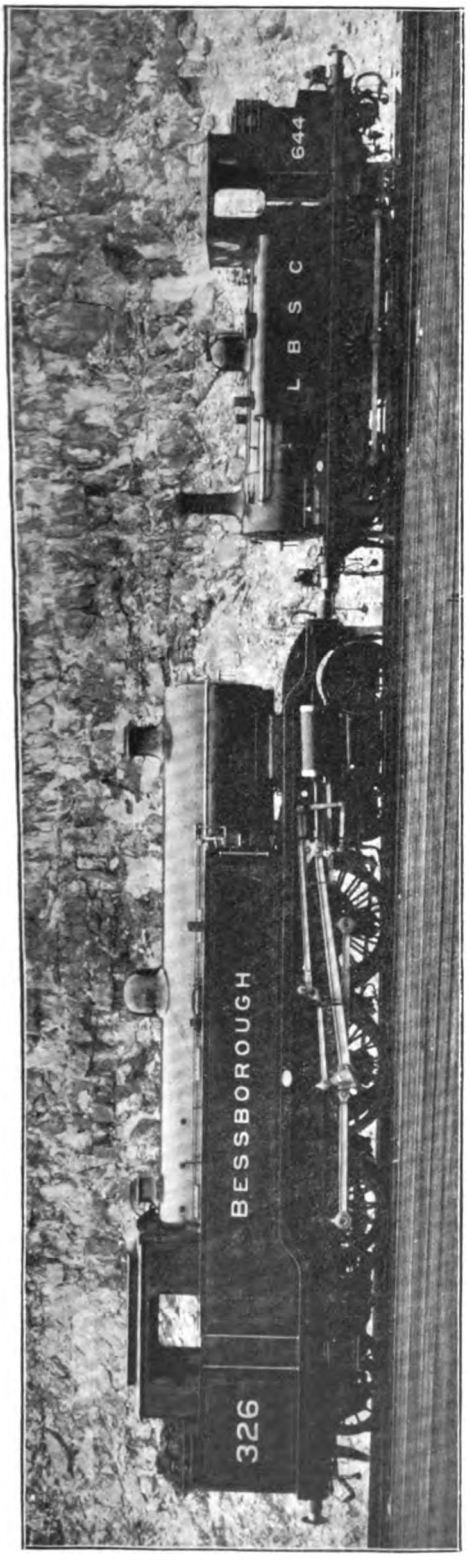

A NEW "DIGNITY AND IMPUDENCE."

No. 326, *Bessborough*, fitted with Schmidt superheater, feedwater heater, Weir feed pump, Walschaert valve gear, etc.; compared with one of the late Mr. Stroudley's 0–6–0 "Terrier" tank engines.

planer fitted with quick return, a planer cutting on both forward and backward strokes, a duplex shaping machine fitted with a radius apparatus for machining chimney bases, a machine for gapping spring blades, a grinder for slide bars, etc.

The fifth bay is partitioned off, one division constituting the brass shop and the other the bolt shop. In the former are benches for fitting work, grinders, polishing bands, cock grinding machines (having an oscillating movement instead of making complete revolutions), turret lathes, ordinary lathes, etc. In the bolt shop, where also screws, stays and similar parts are made, are various turret and capstan lathes, and a number of special machines. Individual mention may be made of several Jones & Lamson lathes with Hartness attachments for turning roof stays and screwing both ends at once from the solid bar, and for making handles and at the same time screwing the bases; two automatic lathes for studs; two-spindle and three-spindle screwing machines, and a four-spindle ordinary tapping machine.

Beyond the machine shop a few steps lead into a gauge, jig and template store for shop use, and next to this is the tool room where tools are made and sharpened. The equipment includes a tapping lathe, a tool grinder, twist drill grinders, file sharpeners, a universal grinder for concave or convex milling cutters, and a universal milling machine. In the corner are hardening and annealing furnaces and a high-speed-steel furnace. A set of master standards, from which shop standards are made, is kept in this division. This department also includes a frame for testing mechanical lubricators. At the end of the erecting shop is a metalling room for inserting white metal in brasses, with a boiling "bosh" alongside for cleaning motion and other parts. An auxiliary entrance to the works is obtained from New England Road by means of steps up the embankment to the tool shop.

Passing along the works yard over the bridge across New England Road the coppersmith's shop is reached. At present this building also accommodates the brass foundry, but as already explained this is to be removed to the other end of the works. It has the usual equipment for these departments. There is no paint shop for the locomotive department in the works proper. Engines and carriages are all dealt with in one large building near Preston Park station.

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ATLANTIC LOCOMOTIVE FITTED WITH SCHMIDT SUPERHEATER.

The running sheds on the other side of the railway may also be mentioned, especially as they are more closely associated with the works proper than is usually the case. Adjoining the South Signal Cabin is the washing-out shed, containing three roads, and 483 ft. long and 50 ft. 9 in. wide. Alongside is the tank house. Two heaters are fitted below and these are supplied with softened water from the Desremaux water softeners adjacent. New sand and lighting-up furnaces are being installed here and the gases from these will go to two locomotive boilers supplying steam to the heaters and for driving the circulating system for washing out boilers. The heaters are fitted with thermostatic control. Beyond the sand furnace a de-oiling plant for extracting oil from waste, etc., is being installed.

The main shed is 201 ft. 3 in. wide and 158 ft. long. It has 14 roads and will usually accommodate about 65 engines, including an average proportion of tender and tank designs. Further west is the turntable and at right angles a small repair shop having a 25-ton overhead electric crane, a wheel lathe and a few other tools. In the yard is a shed containing a hydraulic drop table for removing wheels from engines. The weigh-table is placed adjacent to the water softeners.

An engine when new from the shops, or after going through the shops for repairs, is handed to the locomotive running department, which then takes charge of it, and arranges the work the engine is to perform until it again requires to go into the shops for repairs. There are 610 locomotives on the line, and these are distributed at the 17 Running Sheds on the system, the 3 principal sheds being Brighton, New Cross and Battersea. This department directly controls the staff employed at these various depôts, chiefly consisting of engine drivers, firemen and cleaners. Fitters, boilermakers, etc., are also retained at the running sheds for the execution of what are generally termed "Running Repairs."

As regards drivers, firemen, cleaners, etc., the running department is responsible for

NO. 325 *Abergavenny* (SCHMIDT SUPERHEATER) AS FITTED WITH VERTICAL FEED PUMP IN CONJUNCTION WITH FEED WATER HEATER.

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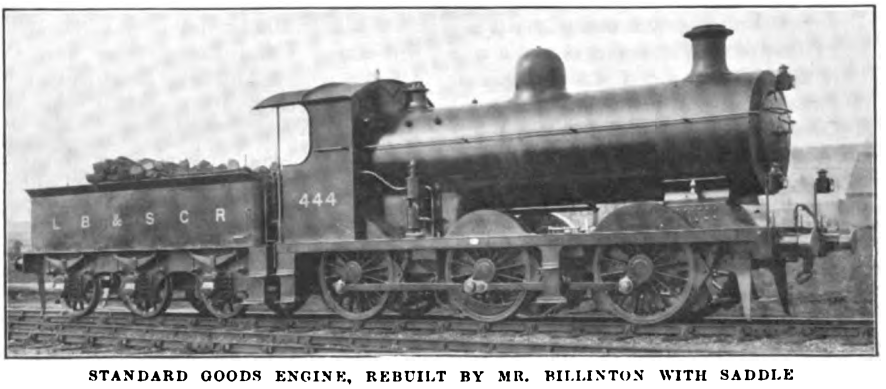
4–4–0 LOCOMOTIVE, REBUILT BY MR. BILLINTON WITH CIRCULAR SMOKEBOX SUPPORTED ON SADDLE AND OTHER FEATURES.

having an adequate number of men to cope with the traffic requirements, which, of course, vary considerably at different periods of the year. All men eligible for promotion from cleaners to firemen, or firemen to drivers, when vacancies occur, are examined and tested at the Outdoor Locomotive Superintendent's Office. Before they are certified as capable of taking their places on the footplate the men are examined as to their knowledge of the rules and regulations, and are instructed in the use of the Westinghouse Brake, and also have to satisfy the Travelling Locomotive Inspectors, attached to this department, that they are capable of taking charge of an engine and working it efficiently and economically.

In addition to the usual eyesight test when entering the Company's service, this department make periodical tests of the eyesight of all drivers and firemen. From 30 years of age the sight of drivers and firemen is tested every 5 years, after 50 years of age annually, and after 60 every three months. An important branch of the work connected with the Outdoor Superintendent's office is the arranging of the work to be done by the engines stationed at each depôt. The duties comprising the working of all passenger and goods trains, and shunting to be done at the various yards and sidings, are issued in a printed book, which is revised several times each year. Every week also from the Outdoor Superintendent's office additional and altered arrangements are issued in connection with special and excursion trains, etc., which are run according to the Special Traffic Notice issued weekly. All delays to trains attributed to locomotive failures or breakdowns also are investigated and dealt with by this department.

From the foregoing it will be seen that, notwithstanding space limitations and the inconvenient location, the locomotive works at Brighton are well laid out and equipped. They are capable of turning out a considerable number of new engines per annum as well as keeping the running stock in condition. It is very rarely now that engines are purchased from outside firms, while the work done by the Brighton engines is sufficient evidence that the locomotive department



STANDARD GOODS ENGINE, REBUILT BY MR. BILLINTON WITH SADDLE SUPPORTING THE CIRCULAR SMOKEBOX.

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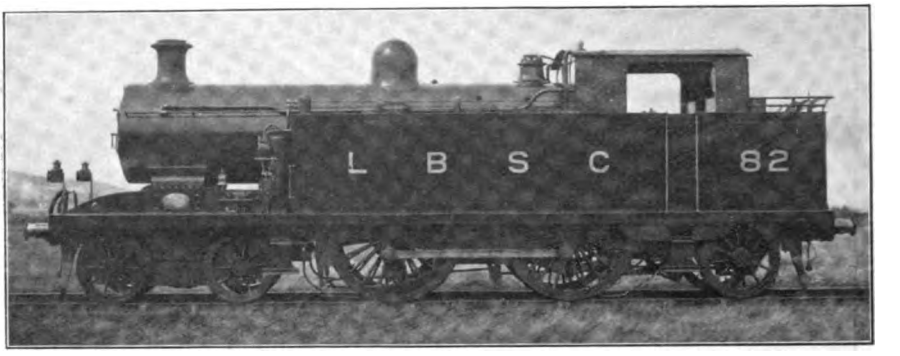

ONE OF THE LATEST 4-4-2 EXPRESS TANK ENGINES FITTED WITH SCHMIDT SUPERHEATER, FEED WATER HEATER AND VERTICAL FEED PUMP.

is capably administered. Steel castings and a few other parts are obtained from outside firms, but speaking generally, everything is done at Brighton which is usually carried out at any large works not provided with special departments such as a steel plant, steel foundry, rail mill and so on.

Several of the more interesting locomotive designs built at Brighton during recent years are illustrated and we have to acknowledge the courteous co-operation and assistance of Mr. L. Billinton, Locomotive Engineer; Mr. J. M. Jackson, Chief Draughtsman, to whom we are indebted for much of the information culled during our inspection of the works; Mr. B. K. Field, Works Manager, and Mr. J. J. Richardson, Running Superintendent, while several of the photographs have been specially taken by Mr. G. F. Burtt, of the Drawing Office staff.

Mr. Lawson B. Billinton was educated at Tonbridge Public School, and went through a course of practical and theoretical instruction in mechanical engineering. He entered the London, Brighton and South Coast Railway works at Brighton as a pupil, and served his time there, passing through all the different branches connected with the building of engines and carriages, and was afterwards appointed a draughtsman. Soon after he was promoted to Inspector and sent to Glasgow to superintend the construction of bogie steel wagons (built there by an outside firm for the Brighton Company) and general inspection work. After carrying out these duties to the satisfaction of the then Locomotive and Carriage Engineer, he was placed in charge of a number of experiments which were made with oil fuel in locomotive engines, and afterwards conducted the experimental trials of the Brighton Company's large passenger express engines. He was then promoted to be the Assistant District Locomotive Superintendent at New Cross, ultimately becoming the Chief Superintendent there, which post he held until the directors selected him to be Locomotive Engineer (at the end of 1911) in place of Mr. D. Earle Marsh, who retired through ill health. Mr. Billinton is now in charge of the whole of the Running Department and all the Locomotive Workshops.

Mr. J. M. Jackson served his apprenticeship with Messrs. Neilson Reid & Co., and before entering the service of the London, Brighton and South Coast Railway in 1906 was for many years a leading draughtsman with Messrs. Sharp Stewart & Co. Mr. B. K. Field was educated at Dulwich, King's College and the City and Guilds Institute, South Kensington. He served for a time at Ashford Works (S. E. & C. R.) under Mr. J. Stirling, and became Chief Locomotive Draughtsman, 1895, and Inspector of Material and Construction, 1898; was appointed Works Manager and Chief Draughtsman at Stoke Works, North Staffordshire Railway, 1892; resigned to manage the Coventry Works of the Motor Manufacturing Co., Ltd., 1893; was appointed Chief Locomotive and Carriage Draughtsman, London, Brighton and South Coast Railway, 1907 and Works Manager in 1912.

Mr. J. J. Richardson entered the service of the London, Brighton and South Coast Railway as fitter's apprentice at Battersea in July, 1867; promoted to Locomotive Foreman at Battersea, April, 1878; appointed District Locomotive Superintendent at Battersea, March, 1898; and appointed Outdoor Locomotive Superintendent of the Line, September, 1900.

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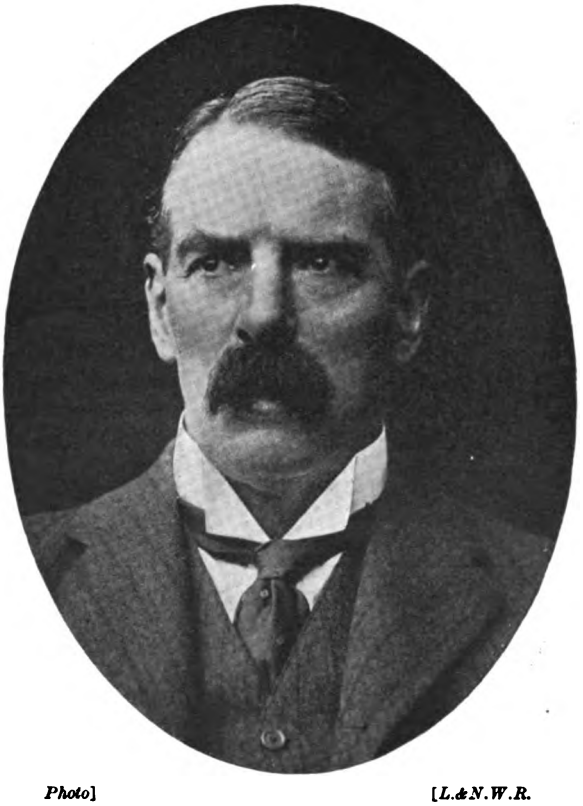
The Royal visit to Crewe.

SIR ROBERT TURNBULL'S RECEPTION AT EUSTON.

THE visit of the King and Queen to the great works of the London and North Western Railway Company at Crewe has left many happy and inspiring recollections. Forming part of the "home" programme, which, as announced in the RAILWAY MAGAZINE at the time, their Majesties definitely decided upon at their accession, the industrial tour in the Northern counties has given pleasure and satisfaction to all classes of their subjects, deeply impressed as they were by the evident determination of the royal visitors to realise on the spot the actual conditions under which leading industries are conducted. Among the stately homes of England none could offer more appropriate hospitality than Crewe Hall, and Cheshire did honour to its ancient character in the cordiality of the welcome extended to King George and Queen Mary. The London and North Western Company also played its part well, and made arrangements that were worthy of its past records, in order that the royal visitors might realise the high standard which has been reached by British locomotive builders.



Photo] [*L.&N.W.R.*

SIR ROBERT TURNBULL, M.V.O.

Superintendent of the Line, London and North Western Railway.

By a happy coincidence, it fell to the lot of one of the Company's own local signalmen to exercise authority as chief magistrate, and Mr. Councillor Manning's colleagues throughout the railway world may well be proud of the affable dignity which marked his reception of their Majesties. But the crowning feature of all in connection with the inspection at the Crewe works was the honour conferred upon a man who throughout a long and honourable career as a railway officer has consistently played a modest, but yet an extremely important, part in the daily work of the pioneer line. In bestowing a Knighthood upon Robert Turnbull, King George created a precedent which has given intense satisfaction, and with excellent tact, singled out for recognition one whose name is held in high esteem by all who know him. At Euston there is indeed none so popular as the new knight, and this feeling of universal respect was abundantly manifested when on his return from Crewe he attended his office at the usual hour on the following morning. The chief officers of all the sections under his control had previously assembled, and when he arrived there was forthcoming a reception such

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as was probably never extended to any other man on the system.

The Company issued as a *Souvenir* of the visit a handsomely-printed description of the works, accompanied by many illustrations of the shops and London and North Western locomotive types of the past and the present. Added to these were the following statistics, which readers of the RAILWAY MAGAZINE will, we are certain, be eager to examine and preserve for reference. With the *Souvenir* was a reprint of the account published in the *Illustrated London News* of the visit paid in January, 1866, to the same works by his late Majesty King Edward VII. when Prince of Wales.

About 8,000 men who were idle in consequence of the recent Royal visit to the works have been paid full wages for the lost time, the cost to the company being about £2,000.

Capital	£116,188,591
Revenue—per annum	£16,733,193
Expenditure do.	£10,885,041
Number of persons employed by Company	86,500
Do. do. do. in Locomotive Dept.	20,683
Population of Crewe	45,354
Miles operated on	3,038
Engines Owned, including Rail Motors	3,111
Carriages do.	9,216
Wagons do.	78,450
Carts do.	7,107
Horses do.	6,086
Steam Ships Owned	16
Passengers carried annually, exclusive of Season Ticket Holders	79,005,445
Number of Season Tickets issued	184,327
Tons of Goods and Minerals carried annually	54,517,214
Number of Stations	800
Do. Signal Cabins	1,294
Do. Signal Levers in use	38,112
Do. Accounts opened last year at Crewe for Special Orders for various Departments	21,000
Annual Value of work done by the Locomotive Department for various Departments, etc.	£919,000

	Mileage of Engines.	Fuel Consumed by Engines.	Water Used by Engines.	Number of Special Trains Run.	
				Passenger.	Goods, etc.
		Tons.	Tons.		
Per Annum	70,393,318	1,862,731	15,833,213	65,185	260,726
Day	224,899	5,951	50,585		
Hour	9,371	248	2,108		
Minute	156	4T. 3c.	35T. 3c.		
Second	2½	155 lbs.	1,312 lbs.		

Lbs. of Water evaporated per lb. of Coal consumed .. .. 8·5.

The yearly engine mileage is equal to a journey—

1.—Round the world every 3 hours.
2.—To the Moon in 29 hours.
3.—To the Sun in about 15½ months.

Crewe Engine Works occupy 137 acres of ground, the covered area being 48 acres.

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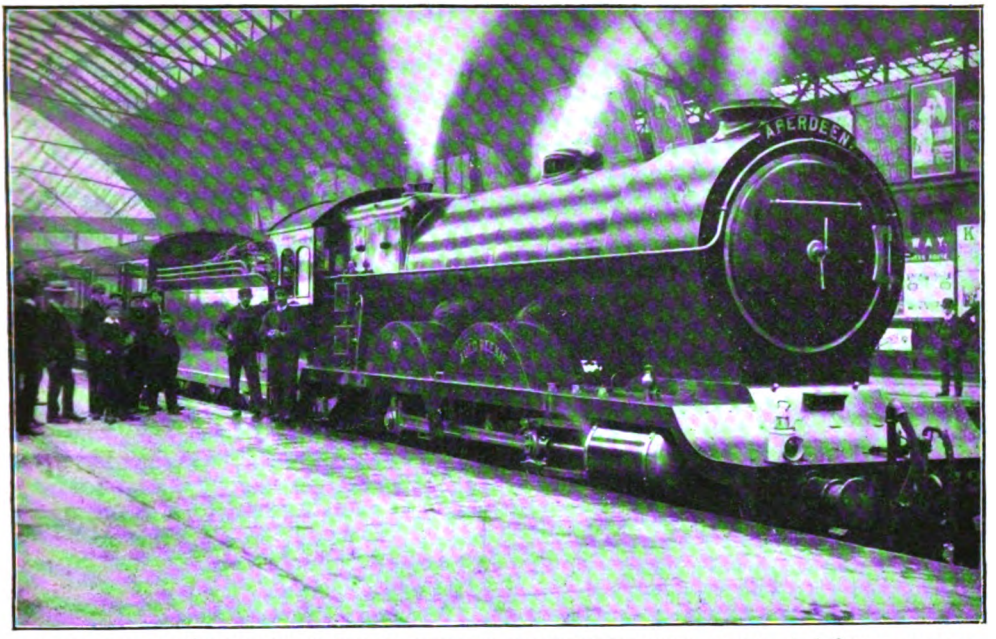

9 A.M. (SUMMER) GLASGOW-ABERDEEN EXPRESS IN QUEEN STREET STATION. 4–4–2 LOCOMOTIVE, NO. 872, *Auld Reekie.*

Express Passenger Locomotives of the North British Railway—1865-1912.

By ALEX K. BOWMAN.

THE running sheds of the North British Railway at Glasgow (Eastfield), Edinburgh (St. Margaret's), and Perth rank among the most interesting in Scotland. It would be far beyond my present aim to make any attempt to detail individually all the North British express passenger types. I shall consider only a few of the more prominent members of the great North British family, together with a record of work done by each.

The North British is the most extensive system in Scotland, with a maintained mileage of nearly 1,350 miles. As has been the case with almost all our railways, it arrived at its present position as the result of the absorption of a number of small lines. Amalgamation succeeding amalgamation, the North British—which name was originally applied to the line opened in 1846 between Edinburgh and Berwick—rapidly grew in size. There was a steady increase in the number of locomotives. The "Monkland" Railway (opened in 1826) and the "Edinburgh and Glasgow" (opened in 1842) were taken over by the North British in 1865. The engines of the former line were 0–4–2's, with 6 ft. drivers and 3 ft. 6 in. trailing wheels, and, until comparatively recently, were to be seen doing service in various parts of the country. They were far inferior, however, to the 2–4–0's of the "Edinburgh and Glasgow," which, with their green bodies, brass domes, and brass fittings, at one time did their best to emulate the old "greyhounds" of the Great Western, both in appearance and efficiency.

A good many years ago I was hauled in an up East Coast express by one of those old "Edinburgh and Glasgow" engines. It was on the north line, and at Dundee the train engine was in difficulties. It was, therefore, relieved of the charge of the train, and the 2–4–0 was sent on as a substitute. The little engine had to climb the $\frac{3}{4}$ mile of heavy incline from Tay Bridge station to the Bridge, but with 130 tons, the time taken between Dundee and Leuchars Junction was little enough over schedule. The $11\frac{3}{4}$ miles of undulating road from Leuchars Junction to Ladybank Junction occupied only 16 min.,

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exclusive of a short stop at Cupar. Those who know the line will appreciate this meritorious performance, and will give it a position such as it must needs occupy. The Edinburgh and Glasgow engines are no longer running the Glasgow and Edinburgh to Alloa expresses, and the local services on the Dundee and Arbroath joint line, where they frequently worked, are now in charge of more modern engines.

Mr. Wheatley, the Locomotive Superintendent of the North British from 1869 to 1874, was responsible for the introduction of two new classes of passenger locomotives. Of the first of these, No. 224, the engine which went down in the Tay Bridge disaster, is a member. It was built as far back as 1871, but, after being recovered from the bed of the Tay, was overhauled and fitted out anew. Since then it has again been rebuilt, and is still running. It is a 4-4-0 with 17 in. by 24 in. cylinders, and 6 ft. 6 in. coupled wheels, and even now is occasionally placed in charge of a comparatively important express train. It is somewhat of a coincidence that five years ago, on the very anniversary of the disaster in December, 1879, it hauled over the present bridge the 5.25 p.m. (now 5.18 p.m.) corridor express from Glasgow to Dundee.

Wheatley's other engines constitute the No. 419 class of 2-4-0's, of which—a year ago, at least—twelve were still in service. These were built in 1873, and have 6 ft. drivers and large leading wheels. They now seldom work any train faster than the 4.15 p.m. from Glasgow to Alloa—usually about 60 tons—which is allowed 45 mins. for the 30 miles from Glasgow to Stirling. This, by the way, is one of the few trains which daily climb the Cowlairs incline without pilot assistance. When hard put to it, however, they—the 419's—are still able to "show a very clean pair of heels"—if I may be permitted to use such a term with reference to a locomotive. This is well illustrated by the following incident, in which No. 424 bore itself brilliantly under very exceptional and trying circumstances. Towards the end of the summer of 1910 I travelled from Newcastle to Glasgow on the 10.35 a.m. Scotch express *ex*-King's Cross, and as far as Dunbar, at which station we arrived at 8.8, two minutes late, schedule time was fairly strictly adhered to. Our engine, however, a North Eastern Railway "V" class "Atlantic"—contracted a heated driving axle, and was unable to proceed farther. The only other available engine under steam was the Wheatley locomotive No. 424. After a delay extending over 36 mins., No. 424 came on to the train, and coupled up. The load was nearly 300 tons, and, as the engine was at first unable to start us, we did not steam out of Dunbar until 8.49—3 mins. later than the booked time of arrival in Edinburgh. Thus, for the 29¼ miles to Edinburgh, we were left with only 26 mins. in order that the 9.15 to Glasgow—on which the East Coast coaches are run to the West—might leave Waverley to time. We emerged from the Abbeyhill Tunnel at 9.19, and came to a stop in the down main platform, Waverley, at 9.22.54. The little engine, therefore, had hauled its big load over the 29¼ miles—an easy road, but hard enough at a pinch—in approximately 34 mins., as against the 38 mins. allowed by schedule.

The Waverley route of the North British Railway is one of the hardest express lines in the kingdom. Leaving Carlisle, it runs along the border for 21¼ miles, crossing into Scotland at Kershope Foot. Eleven miles are undulating, and then begins an eight-mile rise, four miles of which are at 1 in 100. It falls slightly for 2¼ miles, and reaches 315 ft. above sea level at 25¼ miles. The succeeding eight miles form a continuous incline of 1 in 75 to Whitrope Summit (955 ft.), 34 miles from Carlisle. At this point, for 11½ miles to Hawick, a descent varying from 1 in 75 to 1 in 100 begins. From Hawick to St. Boswell's—12¼ miles—there is a rise for 6 miles, succeeded by a decline of similar length, and thence to Galashiels no difficulties in the way of gradients are encountered. From Galashiels to Falahill the line is severely inclined, but from the Summit (850 ft.) there begins a continuous fall of 15 miles—eight of which are at 1 in 70—to Portobello, whence, after an easy stretch of 1⅛ miles it rises into Waverley station at 1 in 78, on the same track as is used by the East Coast trains.

From the foregoing rough description of the Waverley Route, it is evident that powerful engines are required to work the trains. The route was opened in May, 1876, and the gradients, together with the ever-increasing weight of the Scotch expresses demanded greater power than any of the locomotives belonging to the company at that time were able to supply. Accordingly, to meet the conditions, the locomotive superintendent, the late Mr.

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Dugald Drummond, introduced an entirely new class of 4–4–0's with 18 in. by 26 in. cylinders and 6 ft. 6 in. coupled wheels. The boiler (10 ft. 3½ in. by 4 ft. 5⅛ in.) contained 201 tubes and 978·29 sq. ft. of heating surface. Thus, together with 102·67 sq. ft. from the firebox, brought the total heating surface up to 1,080·96 sq. ft. The grate area was 21 sq. ft., and the working pressure 150 lbs. per sq. in. These engines formed class No. 575, of which No. 575 itself appeared as an illustration in Mr. Tom Moffatt's article on the North British Railway in the RAILWAY MAGAZINE [January, 1911; p. 5.]. Their work has always given eminent satisfaction, and they have recently been rebuilt by Mr. Reid, who is now at Cowlairs. Some details of them were given in the RAILWAY MAGAZINE [May, 1912]. This being so, I need say no more than that, not long ago, I had a run behind No. 574 on the 4.49 p.m. Glasgow–Perth express, consisting on the day in question of 107 tons. The fastest section of the run was between Cowlairs and Larbert —20 miles in 22 mins. 37 secs.—but the remainder of the journey was done in equally good style, taking the large number of stops into consideration.

4.49 P.M. QUEEN STREET-PERTH EXPRESS PASSING COWLAIRS: 4–4–0 LOCOMOTIVE NO. 732.

Passing over some 11 years, we come to the year 1886, when Mr. Drummond's successor, Mr. Matthew Holmes, introduced the famous No. 600 class of 4–4–0's. These, the "greyhounds" of the North British Railway in the 1895 races, had 7 ft. drivers, and a heating surface of 1,250 sq. ft. No. 602, the second last engine in the series, had the honour of hauling the first train over the Forth Bridge on March 4, 1890, and No. 592 took the Gold Medal at the Edinburgh International Exhibition in 1886. Four years later the 633's appeared. These and the 600's constitute what is really one large class, the only outward difference —up till a year ago, when the 600's were rebuilt [*See* RAILWAY MAGAZINE, May, 1912]—being that the 633's had 6 ft. 6 in. coupled wheels. Old as is the combined class, its members virtually monopolised the heavy Edinburgh and Glasgow cross-country traffic until some three years ago, and did splendid work on the non-stop trains. They are too light, however, to work with great success the very heavy trains which are now running over almost all the North British System. Even on the flattest road in Scotland (Edinburgh – Glasgow, North British) they are taxed to run hard—that is without being pushed — with more than 230 tons behind the tender. No doubt if they had to be fallen back upon in an emergency they would be able to do even better work than was done by No. 424—above mentioned — between Dunbar and Edinburgh. Ample scope is given them to do really good work over the Glasgow to Perth road, which runs through some very difficult country, though the loads are not usually very severe, and the schedules only moderately difficult. The Edinburgh and Glasgow expresses are now more commonly worked by 18¼ in. cylinder engines of Class 729, and by the "Scott" class.

While the Caledonian locomotive department was busily engaged in turning out the second "Dunalastairs" (1889), the North British produced a heavy new 4–4–0 type—the 729's, which number inclusively 729 to 742, and 765 to 770. Their chief dimensions are: Coupled wheels, 6 ft. 6 in.; cylinders, 18¼ in. by 26 in.; total heating

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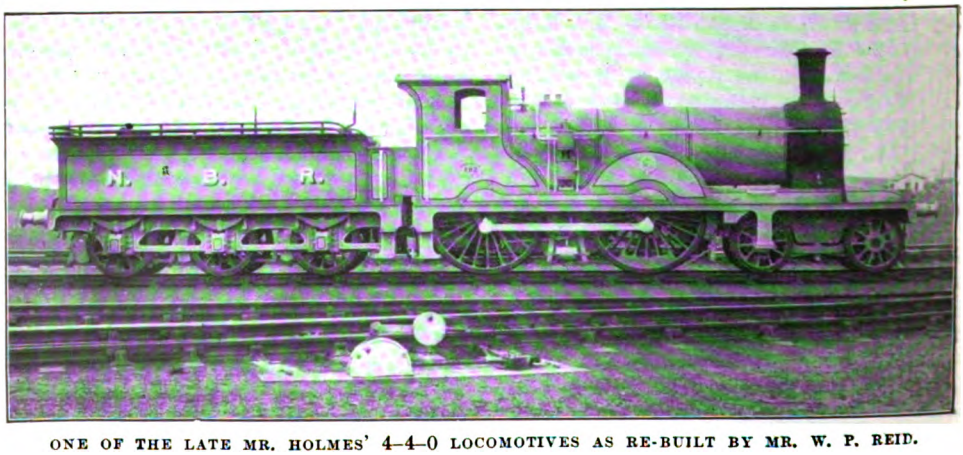
surface, 1,350 sq. ft.; working pressure, 175 lbs. per sq. in.; weight of engine and tender, 87 tons in working order. It will, therefore, be seen that these marked a great advance in size and power. Their introduction enabled the company to place itself on a much more equal footing with the Caledonian than it had been since the coming of the "Dunalastairs" in 1896. The 729's are still working over every line on the system, and although gradually growing too light for the hardest routes they are still doing splendid work. A short time ago one of them ran the 3.55 p.m. non-stop express *ex*-Carlisle—107 tons on this occasion—over the Waverley route so well that it arrived in Edinburgh at 6.4.55, fully 5 mins. ahead of schedule.

In 1903 the No. 317 class was introduced. In this type the coupled wheels remained the same, but the cylinders increased to 19 in. by 26 in., the heating surface to 1,577 sq. ft., and the boiler pressure to 190 lbs., while the weight in working order became 92 tons. The capacity of the tender tank is 3,525 gallons and the fuel space 5 tons. I have before me the record of a run behind No. 319, in which, with a 305-ton train, it gained 7 min. on a 60-min. schedule between Waverley and Cowlairs—a distance of 45¾ miles. No appreciable effort was noticeable in this performance. It is on the North road, however, that one looks to the 317's to do their best work, and they can always be relied upon to carry out every duty with a maximum degree of efficiency.

Besides being the largest railway system in Scotland, the North British is the possessor of the most extensive marshalling yard (Portobello), the greatest bridge (the Forth), and the longest bridge (the Tay) in the United Kingdom, as well as the largest station and hotel (Waverley), the greatest amount of rolling stock, and the longest tunnel—Glenfarg, 2,520 yards, including the two sections and the cutting between—in Scotland. In 1906 this list was augmented by the addition of the heaviest engines in Scotland—Mr. Reid's portly "Atlantics." Fourteen of these great engines—Nos. 868 to 881—were built in 1906, their principal dimensions being as follow:—

Diameter of bogie wheels..	3 ft. 6 in.
,, ,, coupled wheels.	6 ft. 9 in.
,, ,, trailing wheels.	4 ft. 3 in.
Cylinders (two outside) ..	20 in. by 28 in.
Boiler:—Length	15 ft.
Diameter	5 ft. 6 in.
No. of tubes	257
Firebox:—Length	9 ft.
Width	4 ft. ¾ in.
Heating Surface:—Tubes ..	2,071·4 sq. ft.
Firebox.	184·8 sq. ft.
Total ..	2,256·2 sq. ft.
Grate Area	28·5 sq. ft.
Working pressure	200 lbs. per sq. in.
Water capacity of tender ..	4,240 gallons.
Coal space	7 tons
Weight in working order:—	
Engine	74 tons 8 cwts.
Tender	45 tons 8 cwts.
Total ..	119 tons 16 cwts.
Length over buffers.. ..	63 ft. 0½ in.

In 1907 there were a number of trains with very fast bookings running between Glasgow and Edinburgh on the one hand, and Dundee and Aberdeen on the other. The "Atlantics" usually hauled these trains, and did magnificent work with them. An average speed of over 46 miles per hour was necessarily maintained by the 10.25 a.m. *ex*-Glasgow and the 11 a.m.



ONE OF THE LATE MR. HOLMES' 4–4–0 LOCOMOTIVES AS RE-BUILT BY MR. W. P. REID.

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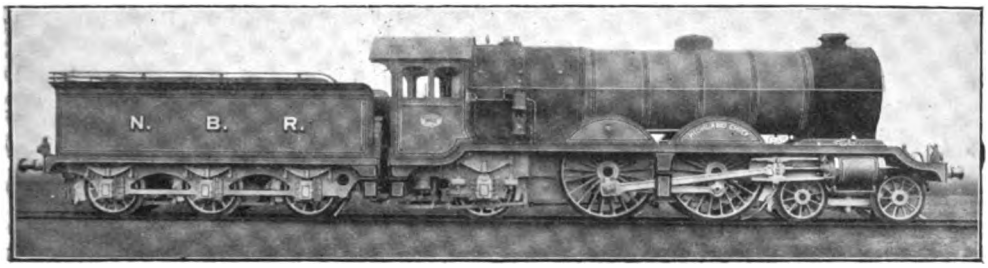

NEW "ATLANTIC" LOCOMOTIVE: DESIGNED BY MR. W. P. REID.

ex-Edinburgh, as also by the 9.30 a.m. and 5.5 p.m. *ex*-Aberdeen, and by the afternoon expresses from the south. Over such a road as the North British Aberdeen line the schedules call for very fine work. The loads were usually from 230 to 270 tons, but the "Atlantics" proved fully equal to the trust reposed in them. It is on the Waverley route, however, that they now have their hardest work. A year ago I travelled from Waverley to Carlisle on the 9.30 a.m. (Winter; due Carlisle 11.50) express, when the load was 110 tons hauled by No. 880, *Tweeddale.* Although time was lost heavily at both the Galashiels and Hawick stops, and further by a series of slacks more or less severe in the Cheviot district and outside Carlisle, we drew up in Citadel Station fully 1 min. ahead of schedule. Returning next morning on the 4.24 (9.30 p.m. *ex*-St. Pancras) express, No. 880 was again in charge, but with 247 tons behind the tender. No assistance of any sort was taken, and schedule time was strictly adhered to. So much indeed was this the case that even between Falahill and Portobello no hard running was necessary. We reached Waverley at 6.56.4, two minutes before time.

I shall do no more than mention the 883 and 383 ("Scott") series of 4-4-0 engines, which made their appearance at various times between 1906 and 1911. The 883's came first, and were built with 6 ft. drivers. In other respects they are somewhat similar to the 317's, though their design is rather different. The engines of the 383's are precisely the same as those of the 883's, but the tenders are larger (4,235 gals.), and this brings the weight of the locomotives up to 98 tons in working order. Two or three of those engines are always to be found on the West Highland Railway, and the remainder have various duties. They are utilised for hauling heavy special express trains, so that, on a Glasgow general holiday, for instance, as many as half-a-dozen may be seen in Queen Street station at one time. In 1909 the first of the now famous "Scott's" were built—at the Hyde-park works of the North British Locomotive Company, Ltd., Springburn, Glasgow—and as, after the "Atlantics" they are the largest passenger engines on the line, I append a few details of their most important features:—

Class	4-4-0
Diameter of bogie wheels ..	3 ft. 6 in.
„ „ coupled wheels .	6 ft. 6 in.
Cylinders (two inside) ..	19 in. by 26 in.
Boiler:—Length	11 ft. 4 in.
Diameter ..	5 ft.
Firebox:—Length	6 ft. 8½ in.
Width	4 ft. 1 in.
Total heating surface ..	1,618·12 sq. ft.
Grate Area	21 sq. ft.
Working pressure	190 lbs. per sq. in.
Water capacity of tender ..	4,525 gallons
Coal space	7 tons
Weight in Working order:—	
Engine	54 tons 16 cwts.
Tender	46 tons
Total ..	100 tons 16 cwts.

For a couple of years only six—Nos. 895-900—of the "Scotts" were in service, but towards the end of 1911 a considerable number, also built by an outside firm, were added to the list. Formerly a "Scott" rarely came west of Edinburgh, but the new engines—*e.g.*, No. 359, *Dirk Hatteraick;* No. 360, *Guy Mannering;* No. 361, *Vich Ian Vohr;* No. 362, *Ravenswood;* No. 243, *Meg Merrilees;* and No. 244, *Madge Wildfire*—are now taking a principal part in the Edinburgh-Glasgow traffic, and manage with the utmost ease the heaviest and fastest of the cross-country expresses. With the introduction in June, 1912, however, of the "Lothian Coast Expresses" (60 mins. Edinburgh-Glasgow, and *vice versa*) they had sterner work to deal with. Though the line between the two cities is level to a degree—except for the Cowlairs incline of 1½ miles at 1 in 46—the numerous permanent way difficulties present obstacles which make it none too easy a task, with a heavy train, to run 47¼ miles in

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60 mins. Nevertheless, there is no question that the "Scotts" are more than ready for any acceleration which may be demanded. As it is they have few enough opportunities of doing their finest work. The following much abridged log of a run from Dunfermline to Perth should suffice as an example of their sterling worth :—

TRAIN: 6.28 P.M. *ex*-WAVERLEY. LOCOMOTIVE: No. 900, *The Fair Maid.*
Load: 240 tons. (2 heavy East Coast Joint Stock coaches; 1 Midland and North British; and 5 North British bogies.)

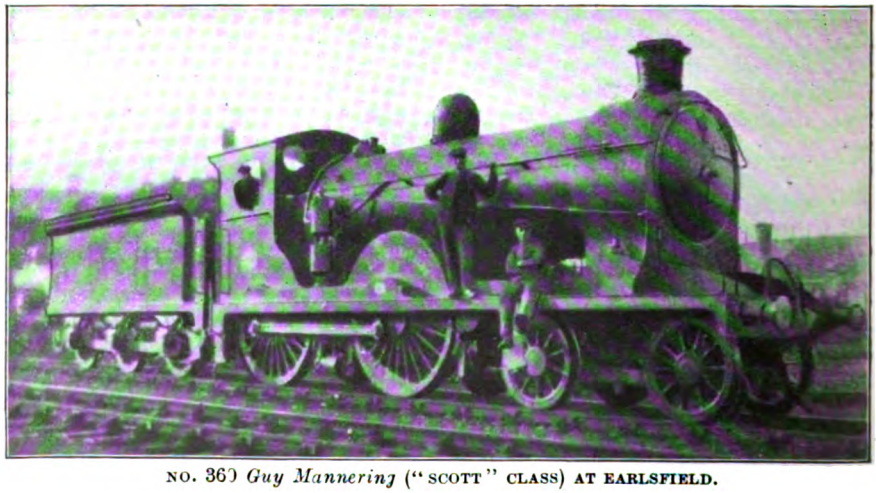
Public Time.	Miles from Edinburgh.	Stations.	Actual Times.	Remarks.
			H. M. S.	
7.4		Dunfermline ..... arr.	7 13 0	Weather: stormy; wet rail.
7.7	16¾	" .....dep.	18 23	Slipped badly at the start.
	22½	Cowdenbeath	29 7	
	24¾	Kelty	31 13	
	30½	Kinross Junction	37 14	Slack at Loch Leven.
	31½	Milnathort	38 19	
	37½	Glenfarg	45 0	} Decline, 1 in 70 to 1 in 80.
	44¼	Bridge of Earn	50 54	
7.52	47¾	Perth ..... arr.	56 37	

Thus, over 31 miles—the first few miles of which are heavily inclined, and the rest, with the exception of Glenfarg, undulating—No. 900 hauled 240 tons in 38 mins. 14 secs. against 44 mins. allowed. No. 321 has taken me over the same road in 36 mins. but, as the load was only 183 tons (2 Highland Railway corridor coaches and 4 North British bogies, and a horse box), and the weather conditions much better, I am inclined to think that the performance of No. 900 is the more meritorious. Six new 4-4-2's—Nos. 901-906—were put on the metals in November, 1911 [See RAILWAY MAGAZINE, January, 1912], and these are doing good work with expresses on the north roads.

In conclusion I reproduce the following from a Perthshire paper of May, 1910:

Interesting speed tests have just been carried out on a stiff upward stretch of 25 miles on the Highland Railway. Two engines—(one of the Highland 4-6-0 "Castles," and one of the North British 883's—No. 867)—each of about 100 tons—were engaged, each coupled to ten 8-wheel bogie carriages. On three successive runs the North British locomotive reached its destination respectively 2 mins., 3 mins., and 2·75 mins. ahead of schedule time, while the Highlander came in 3 mins., 1·25 mins., and 2·5 mins. behind time.

I learn that in a similar test on the North British Railway, between Perth and Kinross Junction—a stretch which involves the climbing of Glenfarg—the North British locomotive had again slightly the better time.



NO. 360 *Guy Mannering* ("SCOTT" CLASS) AT EARLSFIELD.

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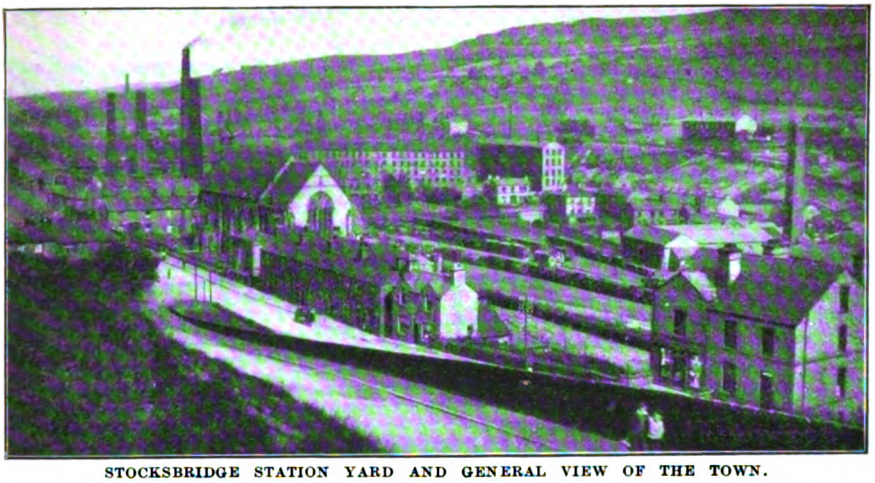

STOCKSBRIDGE STATION YARD AND GENERAL VIEW OF THE TOWN.

Britain's Smallest Railways.

By W. C. GENTRY.

IT is a fairly easy task to answer the question as to which is the largest or greatest railway in the United Kingdom, though even in this matter it is necessary to explain whether statistics of mileage, capital, gross or net receipts, number of passengers or tonnage of goods conveyed, train mileage, or the like, are used as the basis of comparison. But there are several small railways which dispute the honour of being the smallest in Great Britain and Ireland, and a review of some of these will be instructive.

When endeavouring to decide which is the smallest British railway, it must be clearly understood that I take into consideration only lines which are open for public traffic, either passenger or goods, and not small private lines such as may be found in hundreds all over the country, connected with mines, quarries, factories, mills and breweries. Lines which are worked by other companies are also omitted. Only one railway company has a line under one mile in length, namely, the Felixstowe Dock and Railway Company, whose line measures 3 furlongs 3 chains. Leaving the Great Eastern Company's Felixstowe Pier branch, just south of the Felixstowe Beach station, it extends to the little Felixstowe Dock on the River Orwell. The line is of standard gauge, and thus vehicles are enabled to run through on the Great Eastern system. Without locomotives or passenger vehicles of any kind, the Company's entire rolling stock consists of 12 goods vehicles. The Felixstowe Dock was constructed in 1887, and has a quayage of 600 ft. The offices are at Felixstowe, and Mr. G. H. Woodmancy is General Manager.

The next shortest line is that owned by the Milford Haven Dock and Railway Company. This railway is 1¼ miles in length, and extends from Milford Haven (Great Western) station along the coast to Newton Noyes Pier, about half way to Neyland. The Company was incorporated in 1860, and the line opened in 1882. Constructed on the standard gauge, it forms a continuation eastward of the Great Western Company's Milford Haven branch. The iron pier at Newton Noyes, at which this line terminates, is a very fine example of that class of work. Running from the land into deep water, it is wide enough for no fewer than five lines of railway abreast, is fitted with hydraulic tip and appliances, and affords excellent loading and unloading accommodation for vessels coming alongside. Midway between Milford Haven and Newton Noyes is situated the well-known shipbuilding yard where some of the finest four-masted sailing vessels afloat were built some years ago. This yard is connected by siding with the Milford Haven Dock and Railway Company's line.

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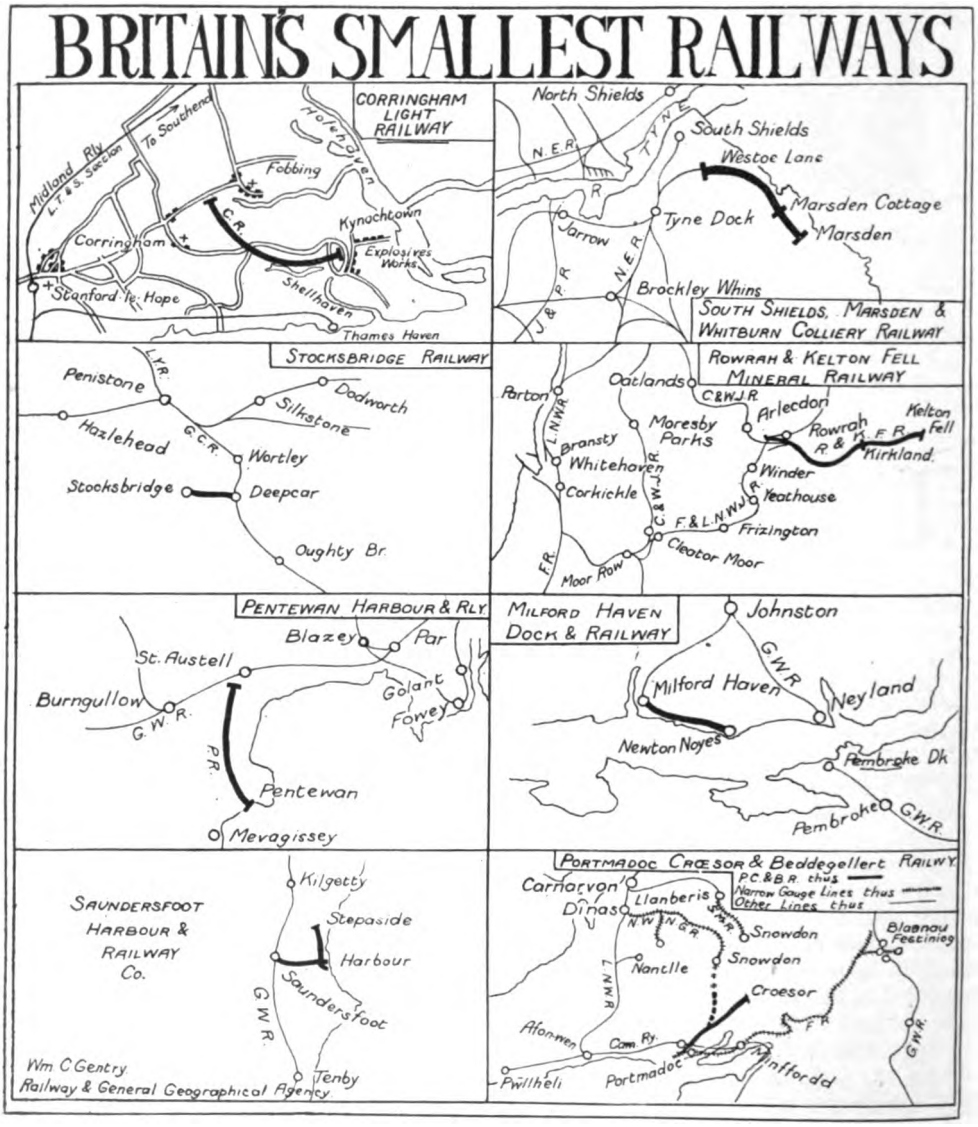
The rolling stock owned consists of 1 locomotive and 21 goods vehicles. No passenger traffic is at present provided for; but in these days, when mineral and goods lines are being opened to passenger traffic (*e.g.*, Burry Port and Gwendreath Valley Railway, Cardiff Railway, Dearne Valley Railway), we must always be prepared for such an eventuality.

The General Manager of the Milford Haven Dock and Railway Company is Mr. J. B. Gaskell, A.M.I.C.E., of Milford Haven.

In 1874 the Stocksbridge Railway Company was incorporated, and two years later the line was opened. Extending from Deepcar on the Great Central Company's Sheffield-Manchester line, to Stocksbridge, its length is 1 mile 7 furlongs 1 chain. Constructed to connect the large steel works in the town of Stocksbridge with the system of the Great Central Railway, the line has been instrumental in fostering the development of the industries in the neighbourhood, chief of which are silica bricks and sanitary tube



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making, and additional siding connections have been laid down. The output of the steel works has also increased enormously in recent years. Besides clay and ganister pits, the locality is rich in a seam of soft coal, which is conveyed over the railway to numerous municipalities for gas production. To allow of through working this line is also constructed on the standard gauge, and the volume of traffic handled approaches 1,000 tons per day. The company's rolling stock equipment consists of one locomotive, built by Messrs. Hadswell, Clarke & Co., Leeds, two passenger carriages, and 68 goods wagons. By the courtesy of Mr. J. G. Jeffery, the Secretary of the company, I am able to reproduce a copy of the current working time table, showing goods and passenger services. As the company possesses but one locomotive, this time table is of special interest. An illustration of the engine referred to appears on page 498. The population of Stocksbridge is about 6,600, most of whom are engaged in connection with Messrs. Samuel Fox & Co.'s steel works.

The following is the working time table of the railway :—

STOCKSBRIDGE RAILWAY—WORKING TIMETABLE.

DOWN.	WEEK DAYS.												
	PASS.	GOODS	PASS. AND GOODS	GOODS	GOODS	GOODS	PASS.	GOODS	GOODS	GOODS	PASS.	GOODS	GOODS
	a.m.	a.m.	a.m.	a.m.	a.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.	p.m.
Stocksbridge Station													
Upper Yard dep.	—	6.55	—	—	10.20	12.10	—	—	2.30	3.50	—	—	6.25
Lower Yard, arr.	—	7.0	—	—	10.25	12.15	—	—	2.35	3.55	—	—	6.30
Do. dep.	5.50	—	8.15	9.10	11.0	12.20	12.40	1.0	2.40	4.40	5.15	—	6.40
Gregory's Siding arr.	—	—	—	—	—	12.25	—	1.5	—	—	—	—	—
Deepcar arr.	5.55	—	8.20	9.20	11.10	— Sats. except.	12.45 Sats. only	— Sats. only.	2.50	4.50 Sats. except.	5.20 Sats. except.	—	6.50 Sats. except.
UP.	PASS. AND GOODS		PASS.										
Deepcar dep.	6.15	—	8.35	9.35	11.25	—	12.50	—	3.5	5.0	5.25	—	7.5
Gregory's Siding dep.	—	—	—	—	—	12.55	—	1.35	—	—	—	—	—
Stocksbridge Station													
Lower Yard, arr.	6.20	—	8.40	9.45	11.35	1.0	12.55	1.40	3.15	5.10	5.30	—	7.15
Do. dep.	6.40	—	—	10.5	11.55	—	—	—	3.35	—	—	6.15	7.30
Upper Yard, arr.	6.45	—	—	10.10	12.0	— Sats. except.	— Sats. only	— Sats. only	3.40	— Sats. except.	— Sats. except.	6.20 Sats. except.	7.35 Sats. except.

Coming to lines from 2 to 3 miles in length, attention is first claimed by the Rye and Camber Steam Tramway. As, however, this line was fully described in the RAILWAY MAGAZINE (October, 1912), it is only necessary to state here, for the purposes of comparison, that the line is 2½ miles in length, possesses 2 locomotives, 2 passenger vehicles and 3 goods vehicles. The railway is on the 3 ft. gauge, and conveys both passenger and goods traffic. Next in order is the little line with the high-sounding name of the South Shields, Marsden and Whitburn Colliery Railway. This is 2¾ miles long, and extends from Westoe Lane station, South Shields, to Whitburn Colliery, a few miles to the South. It is built to the standard gauge, and effects a junction with the North Eastern Railway at South Shields. Passenger traffic is worked over the line from Westoe Lane to Marsden. An intermediate halt exists at Marsden Cottage. The journey occupies ten minutes, and a good service of trains is run both week-day and Sunday. A curious feature of the timetable is that certain trains are timed to run on "Baff Saturdays only." Miners in the Durham district, as many readers will be aware, are paid every alternate Saturday, and "Baff" Saturday is the intervening Saturday when they are not paid.

Two railway companies possess lines only 3 miles in length, the older of the two being the Rowrah and Kelton Fell Mineral Railway Company. This Company was incorporated in 1874, with powers to construct a standard gauge railway from Rowrah on the Furness and London and North Western Joint Railway to Kelton Fell iron-ore mines, passing *en route* Kirkland siding. This line, opened on January 1, 1877, is 3 miles 4 chains in

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length. The rolling stock is restricted to 1 locomotive. Connection is made at Rowrah with the Furness, London and North Western and Cleator and Workington Junction Railways. The Corringham Light Railway is close to London, yet very few Londoners are aware of its existence. It is almost unique among British railways in being isolated from other lines, as far as passenger traffic is concerned, the only other similarly placed railway on the mainland being the Campbeltown and Machrihanish Light Railway, Kintyre. Starting at Fobbing and Corringham, about three miles to the east of Stanford-le-Hope station on the Midland Company's Tilbury line, the Corringham Light Railway runs south and east to Kynochtown, Essex, physical connection being effected with the Midland close to Thames Haven station by means of a goods siding which extends from that company's line to the works at Kynochtown. Of standard gauge, it was constructed by Messrs. Kynochs, of Birmingham, to connect their explosives works at Kynochtown with the adjacent villages of Fobbing and Corringham. It was opened for goods traffic on January 1, 1901, and for passenger traffic on June 29, of the same year. The rolling stock consists of 2 locomotives, 2 passenger vehicles and 10 goods wagons. Like the Rye and Camber and Stocksbridge lines, the train services of the Corringham Railway are omitted from "Bradshaw," but the Corringham time table is as follows:—Leave Corringham 5.40, 6.40, 8.48 a.m., 1.15, 1.40 S.O., 2.40, S.O., 5.35, 6.35, and 7.40, S.O., p.m. Leave Kynochtown 6.10 a.m., 12.35 N.S., 1.10 S.O., 2.5 S.O., 5.10, 6.15, 7.0 S.O. (S.O., Saturdays only; N.S., Saturdays excepted).

Attention must now be directed to lines over 3 miles in length, and here we come to the Snailbeach District Railways Company. This Company operates a system of narrow gauge railways with a total route mileage of 3 miles 2 furlongs 5.44 chains. Constructed to the gauge of 2 ft. 4 in., it begins at Pontesbury, on the Minsterley branch of the Great Western and London and North Western Companies' joint Shrewsbury and Welshpool Railway, and extends southward to the Snailbeach mines, with a branch to Crow's Nest mine. This is a purely mineral carrying railway, and undertakes no passenger traffic. The Company possesses 2 locomotives and 57 goods vehicles. Incorporated in 1873, the undertaking has its headquarters in Upper Brook Street, Oswestry, the Secretary being Mr. A. H. Bardswell. It may be mentioned that the Snailbeach District Railway is the only line in the United Kingdom built on the 2 ft. 4 in. gauge.

STOCKSBRIDGE RAILWAY LOCOMOTIVE.

The Great Northern and City Tube Railway should be mentioned next as being only 3½ miles in length, but a description of this important line among the others referred to would here be out of place. The volume of its passenger traffic, as part of the tube railway system of the Metropolis, placing it in an entirely different category. The Pentewan Harbour and Railway Company, sometimes known as the Austells and Pentewan Railway Harbour and Dock

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Company, comes next. Pentewan is a small village port to the south of St. Austells (Cornwall), and the Pentewan Railway is engaged in the conveyance of China clay from St. Austells to the harbour at Pentewan for shipment. No passenger train service is provided. The total length of the line is 4 miles, gauge being 2 ft. 6 in. (the same as the Welshpool and Llanfair and Leek and Manifold Valley Railways). The Company possesses 1 locomotive, 1 passenger vehicle, and 42 goods wagons. Traffic is not heavy at present, but the Company have recently been considering the question of remodelling the line. It would not be an unprecedented development for a mineral railway to become an important passenger line, such a change having only recently been carried out on the erstwhile East Cornwall Minerals Railway, now known as the Bere Alston and East Cornwall Light Railway. St. Austells has manufactures of iron and machinery, but its most important industries are the local china clay works and tin and copper mines. Great quantities of china clay and china stone are exported from the adjacent harbours at Charlestown and Pentewan. Pentewan has mines and quarries of the well-known Pentewan stone. The harbour, which belongs to the Pentewan Railway Company, is a good one, and provides excellent quay accommodation.

Another line of only 4 miles is that owned by the Saundersfoot Harbour and Railway Company. This extends from Saundersfoot station, on the Great Western Pembroke and Tenby branch, to the harbour on the coast, with a branch northwards to the Stepaside Coal Mines. The gauge is 4 ft., and all through traffic has, therefore, to be transhipped. One locomotive and 71 goods vehicles are sufficient to meet the requirements of the traffic. Saundersfoot has a commodious harbour, coal and iron being exported. The only other lines under 5 miles in length are the Portmadoc Crœsor and Beddgelert Tram-railway (4½ miles), and the Mersey Electric Railway (4¾ miles). This latter does not come within the purview of this article, inasmuch as to all intents and purposes it is a "tube" line similar to the Great Northern and City previously mentioned.

The Portmadoc Crœsor and Beddgelert Tram-railway was opened in 1864. Its gauge is 1 ft. 11½ in., similar to the Festiniog and North Wales Narrow Gauge Railways, and the line beginning at Portmadoc by a junction with the Festiniog Railway, proceeds for 4½ miles up the Crœsor Valley. A branch is projected up the pass of Aberglaslyn to Beddgelert, where a junction would be effected with the authorised extension of the North Wales Narrow Gauge Railway. A new company—the Portmadoc, Beddgelert and South Snowdon Railway—has been formed to carry out this work, and also to acquire the existing lines of both the Portmadoc Crœsor and Beddgelert and North Wales Narrow Gauge Railways. Further branches are projected to Bettws-y-Coed and Carnarvon, and should these proposals be carried out, an important amalgamation of the narrow gauge lines in this part of the country may be anticipated. At present, however, the Portmadoc Crœsor and Beddgelert line is almost derelict, and possesses no rolling stock of any description. Passenger traffic is not conveyed over the line, and mineral traffic is worked in owners' wagons by horse traction. The Secretary and Manager of the line is Mr. J. E. Jones, of 16, Bask Place, Portmadoc.

I have now completed a survey of British railways under 5 miles in length, and it is left to readers to decide which of these may be considered as the "smallest" as distinct from the "shortest" line. A description has been given of 13 railways, the combined mileage of which amounts to only 38¾ miles. Of these 13 railways, 5 are of narrow gauge, 5 convey passenger traffic, and 4 are owned by companies possessing docks or harbours. Of railways over 5 miles and under 10 in length there are 18. Out of a total of 121 railways in the British Isles, only 25 exceed 100 miles in length.

Passing reference should be made to a little line of 2½ miles, somewhat similar to the Rye and Camber Tramway. This is the Wantage Steam Tramway connecting the town of Wantage with the Great Western Railway at Wantage Road station. The company possesses 5 locomotives and 5 passenger vehicles, but is omitted from this article, as the trams, although running to a time table, stop anywhere to pick up or to set down passengers.

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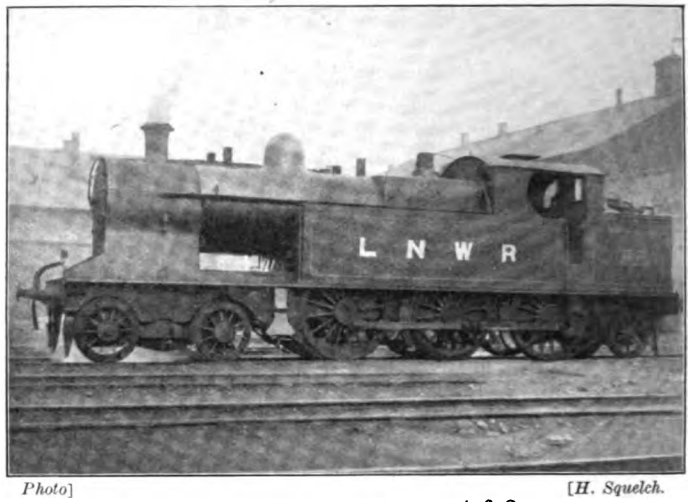
The Tank Engines of a Great Railway.

By REGINALD H. COE.



Photo] [*H. Squelch.*

LONDON AND NORTH WESTERN RAILWAY: 4-6-2 TANK ENGINE.

IF electricity is ever to replace steam as a motive power on our railways, it will naturally begin with the local traffic, as in some parts of the country it is already doing. This will, of course, mean the gradual displacement of the tank engine, a type of locomotive that has held undisputed sway on every British line since the commencement of the railway era. I have not here the space to discuss the merits or disadvantages of the tank engine, and will only say that at the present time, at any rate, all our leading companies have large numbers of that useful class of engine.

Particularly is this the case on the London and North Western Railway, where nearly half the stud of 3,000 odd locomotives are tank engines. In fact, on no other line, perhaps, can more variety of tank engine types or a greater variety of each type be found. This is easily explained by the fact that the company possess an unusually large amount of local traffic. One has only to remember that the "Premier" line is to be found in such vast centres of population as London, Birmingham, Manchester, Liverpool and Leeds, to enable one to understand that the local traffic must be enormous. There is in addition plenty of country branch work, and on some sections of the North Western system in Wales the tank engine reigns supreme. I desire at once to describe briefly the existing types of the tank engines running on the London and North Western Railway.

PASSENGER TANK ENGINES.—(1) "PACIFIC" OR 4-6-2 TYPE.

The latest type of passenger tank engine is the 4-6-2 type, of which there are now 32 running. They are a fine sturdy class of engine and were only brought out in January, 1911, being built to the designs of Mr. C. T. Bowen Cooke, the Chief Mechanical Engineer. I must refer those of my readers who desire the dimensions of these engines to earlier numbers of the RAILWAY MAGAZINE, where they have all been published. Sufficient be it to say that they are a most useful addition to the company's stock, for not only can they deal easily with the heaviest local traffic, but

Photo] [*H. Squelch.*

LONDON AND NORTH WESTERN RAILWAY:
4-4-2 TANK ENGINE IN NEW STREET STATION, BIRMINGHAM.

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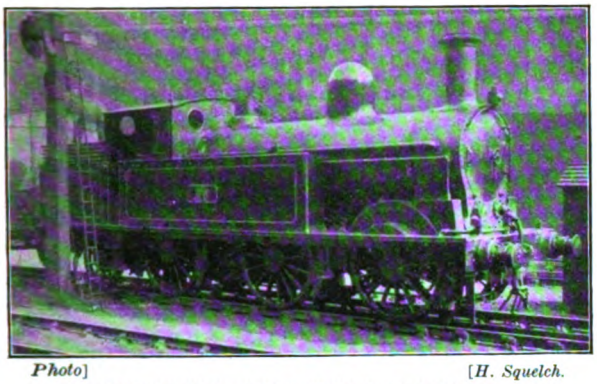


Photo] [H. Squelch.

LONDON AND NORTH WESTERN RAILWAY: 0-6-2 RADIAL TANK ENGINE.

they are able to undertake semi-fast main line work. For the latter purpose they are fitted with the pick-up-water apparatus and an extended coal bunker. Twenty of them are fitted with the Schmidt superheater, now adopted by the London and North Western Railway, and are principally stationed in Birmingham and London, while a goodly number work the Central Wales expresses over that somewhat continuous route. Such sheds as Rugby, Stafford and Shrewsbury have also one or two stabled. The numbers of those so far running are as follow: 91, 217, 327, 375, 376, 632, 704, 716, 858, 915, 932, 944, 962, 1183, 1186, 1366, 1416, 1533, 1638, 1688, 1692, 1710, 1728, 1734, 1797, 2004, 2665, 2666, 2667, 2668, 2669 and 2670.

(2) "PRECURSOR" OR 4-4-2 TYPE.

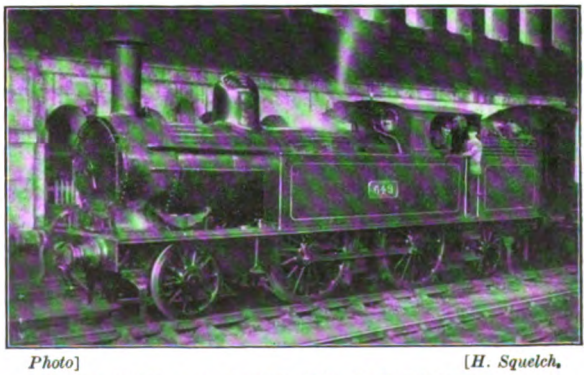
Prior to the introduction of the Pacific Tanks described, the chief tank engine was the "Precursor" type, "Atlantic," or 4-4-2 type. These were so named as they resemble in a large degree the famous 4-4-0 express engines, and are in fact fitted with "Precursor" boilers. They are a fine and graceful-looking class, and have done good service. The first of the 50 now running was completed in May, 1906, to the designs of the late Mr. George Whale. They work principally in the London district and at Manchester, but are not confined in this sphere. At one time there were many stationed in Birmingham, but the majority have now been replaced by the 4-6-2 tanks. Incidentally, it may be mentioned, they were the first North Western locomotives to have the company's initials and crest painted on the side sheets. Their numbers are as follow: 44, 97, 111, 139, 181, 196, 527, 528, 531, 562, 612, 616, 653, 762, 784, 803, 827, 834, 874, 875, 920, 935, 1164, 1219, 1295, 1305, 1356, 1427, 1506, 1508, 1523, 1536, 1551, 1572, 1589, 1671, 1714, 1764, 1981-5, 2077, 2165, 2196, 2210, 2223, 2228, and 2246.

(3) RADIAL, OR 0-6-2 TANKS.

The last tank engine which the late Mr. F. W. Webb produced was of the Radial, or 0-6-2 type—a very useful and handy locomotive. These are now to be seen on all parts of the London and North Western system, and are frequently used for goods trains. Owing to their six-coupled wheels, they are able to deal with tremendous loads, and are always to be depended upon. The first made its appearance in 1898, and there are now about 80 running. Their numbers are as follow: 4, 14, 16, 29, 31, 46, 55, 76, 78, 80, 105, 115, 118, 167, 182, 188-9, 194, 235, 280, 283, 309, 312, 317, 345, 354, 358, 368, 377, 398, 495, 583, 586-7, 593, 599, 624, 646, 654, 656, 664, 741, 775, 938, 972-3, 983, 1023-4, 1032, 1095, 1140, 1560, 1562-4, 1574, 1587-8, 1590, 1593, 1596-9, 1601, 1608, 1615, 1622, 1626-7, 1635, 2016, 2019, 2020, 2026, 2028, 2037, 2113, 2211, and 2382.

(4) 5 FT. 6 IN. 2-4-2 ENGINES (159 IN NUMBER).

Before he resorted to the 0-6-2 type of tank, Mr. Webb brought out a large number of 2-4-2 tank engines, with 5 ft. 6 in. driving wheels. These were of impressive appearance, and they have done excellent



Photo] [H. Squelch.

LONDON AND NORTH WESTERN RAILWAY: 2-4-2 DOUBLE-ENDER TANK ENGINE.

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work. Nearly every shed on the London and North Western Railway has a number of them stabled, and for all-round work they have hardly ever been beaten. The rate of speed they can attain at times is surprising.

(5) 4 FT. 6 IN. 2–4–2 TANKS.

A smaller and older class of the same engine is also much in evidence on the London and North Western Railway, and is now proving useful in conversion to motor train engines. A large number have recently been scrapped, but about ten are converted into

(6) 2–4–0 TANK ENGINES,

and are at work on certain sections of the line.

TANK ENGINES FOR GOODS TRAINS AND MIXED TRAFFIC PURPOSES.

(7) 0–8–2 TANKS.

The latest and largest creations on the London and North Western Railway are the huge and powerful 0–8–2 shunting engines. There are at present ten of these monsters running, and, like all new London and North Western Railway tank engines, they have the letters "L.N.W.R." in large size on the side tanks. Most of them are working in the large sorting sidings at Crewe, where they are giving evidence of their tremendous hauling powers.

(8) 0–6–2 GOODS TANK LOCOS.

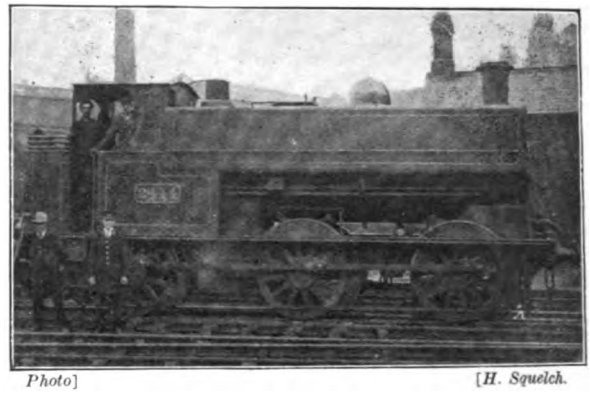
During Mr. Webb's *regime* at Crewe, a large number of 0–6–2 goods engines, with 4 ft. 3 in. driving wheels, were turned out, and that their existence was justified has been more than proved. They are most handy for shunting and short distance goods trains, and, despite their small wheels, can get up quite a good speed. In fact, they have been, and are now, largely used on local trains.

(9) 0–6–0 SQUARE SADDLE TANKS.

These saddle tank engines, of which there are 45 running, are really converted 0–6–0 goods engines. They differ from the usual type of saddle tank in that they have a square saddle over the boiler.

(10) 0–6–0 ROUND SADDLE TANKS.

The older 0–6–0 "special" saddle tanks are legion on the London and North Western Railway—wherever one goes on that system they can always be seen in large numbers.



Photo] [H. Squelch.

LONDON AND NORTH WESTERN RAILWAY: SHUNTING ENGINE, WITH SQUARE SADDLE TANKS.

They constitute a handy class of locomotive, and present a most pleasing appearance. Although built solely for shunting and pilot purposes, they work passenger trains in the event of an engine breakdown. Some have been rebuilt with closed-in cabs, but in the opinion of many experts they do not then look so attractive as when in their original state.

(11) 0–4–0 SADDLE TANKS.

There are a few very old 0–4–0 saddle tank engines running, all of which remain in Crewe works.

(12) 0–4–2 SADDLE TANKS.

The London and North Western Company also own about 20 0–4–2 saddle tanks, with square saddles and small solid wheels under the coal bunker. These are for use at docks and other places where there are sharp curves.

(13) 0–4–2 CRANE ENGINES.

There are running some rather peculiar 0–4–2 crane engines. These have a small crane fitted to the rear, and are exceptionally useful in case of a breakdown.

(14) 0–6–0 OIL TANKS.

The London and North Western Company also possess two 0–6–0 saddle tanks, which use liquid oil instead of coal. These are unique in being the only tank engines bearing names, which are "Euston" and "Liverpool," respectively.

(15) NORTH LONDON TANKS.

Mention must likewise be made of the 12 North London Railway tanks, taken over by the London and North Western Company. These are of the 4–4–0 and 0–6–0 types, and work at Willesden and Rugby.

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The Channel Tunnel:

GOVERNMENT INQUIRY ORDERED.

TIME certainly worketh many wonders! Less than six years ago, after an inquiry instituted within the closed doors of the Committee of Imperial Defence, His Majesty's Government decided that the Private Bill which proposed the construction of a Channel Tunnel should not be allowed to proceed. To-day "this matter is under the consideration of the Departments concerned," says the Prime Minister. What has happened to bring about such a very remarkable change in the official attitude towards this great project? The promoters of the original scheme have not moved a finger, but have quietly and unostentatiously kept the Channel Tunnel Company alive. Nor has any definite declaration of public opinion been either invited or expressed. But other, and still more irresistible forces, have been in silent operation. The explanation of these altered circumstances is to be found solely in the fact that what was, in 1907, regarded as a proposal fraught with peril to British power is in 1913 recognised as essential to the safety of the Empire and the preservation of European peace!

We have, therefore, not the least hesitation in affirming that the prospect of a Channel Tunnel at last seems assured. Its realisation, however, will come not as the immediate result of any private enterprise, but as the natural outcome of international confidence and goodwill. To England as much as to France such a work is destined to prove an element of incalculable benefit, and to the Continent of Europe as a whole a public and commercial boon of enormous value. The ill-founded fears and prejudices which existed a few years ago are not likely any longer to deflect the judgment of representative men on this side of the Dover Straits, and some of us will no doubt ere long be ashamed to recognise that our French neighbours were right when they refused to entertain the "invasion" bogies which have hitherto been sufficient to prevent the completion of a submarine railway between England and France. The inquiry which, as Mr. Asquith announced on April 24th this year, has been undertaken by the Departments concerned, affects the Admiralty, the War Office, and the Board of Trade. It will, of course, be private and confidential, and the opinions of these three branches of the Public Service will in due course be laid by the Prime Minister before the Committee of Imperial Defence, which is already in possession of the elaborate plans, military, engineering, geological, commercial, and other data prepared, at great expense, by the promoters of the Bill which had in 1907 to be withdrawn. The Government may then feel fully justified in proposing that the scheme shall forthwith be carried out under international agreement and direction, or they may decide that a public investigation shall follow. In such an eventuality, a Joint Committee of both Houses of Parliament would in all probability be formed for the purpose, and as the enormous pressure of work already resting upon the shoulders of the Prime Minister might naturally prevent the right hon. gentleman presiding over the deliberations of such an important body, the choice of chairman might be expected most appropriately to fall upon that distinguished soldier and diplomatist Lord Sydenham, who, when Secretary of the Committee of Imperial Defence, became familiar with every argument that can be advanced for and against the Channel Tunnel. The railway companies of the United Kingdom will await the issue with the keenest interest. It is quite possible that the visit of M. Poincaré will serve a useful purpose in furtherance of the project.

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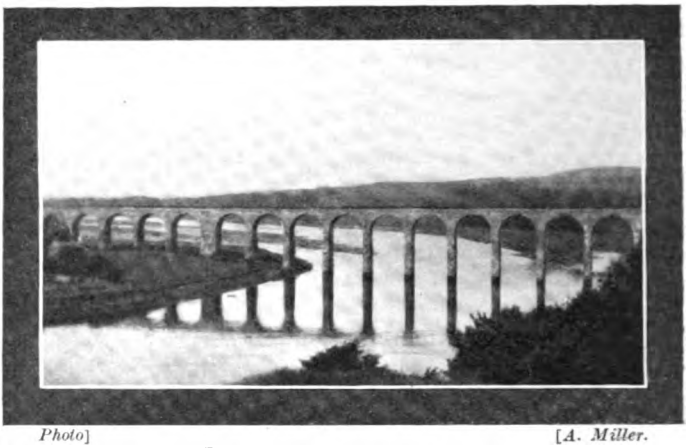
A Notable Railway Viaduct:

THE ROYAL BORDER BRIDGE AT BERWICK.

By J. W. MILLER.



Photo] [A. Miller.

THE ROYAL BORDER BRIDGE.

BRITAIN is the mother of railways. It is fitting, therefore, that Berwick-on-Tweed, on the Eastern Borders of England and Scotland, should possess one of the finest railway viaducts in the kingdom. Of comparatively few railway bridges can it be truthfully said that they enhance the attractiveness of the valley they span, but this may be readily conceded in regard to the Royal Border Bridge, the 28 semi-circular arches of which cross the Tweed near the mouth of that far-famed Border river. This stupendous viaduct connects the North Eastern and North British Railways, and represents one of the great engineering feats of Robert Stephenson. The Royal Border Bridge originally connected the York, Newcastle, and Berwick Railway with the North British line. It is the property of the North-Eastern Railway Company, and is a prominent landmark on the East Coast Route, sometimes called the "Bridges Route." When it was opened by Queen Victoria, more than half-a-century ago, Her Majesty expressed great admiration of its lofty and graceful arches, and gave her command that it should be named "The Royal Border Bridge." The opening ceremony, according to Stephenson, was "the last act of union," for it completed the railway chain from London to Edinburgh. The foundation-stone was laid in May, 1847, and the last arch was keyed in March, 1850, the actual time occupied in its construction being three years, three months, three weeks and one day. The abutment at the north end is built on the steep bank of the Tweed, where once stood Berwick's famous Castle, and a small portion of the ruins of the stronghold can be seen reaching down to the water's edge. "It is distressing," laments a well-known writer, "that nearly all of the ancient Castle, which must have stood up so proudly at the highest angle of that almost perfect circuit of enclosing wall which still haply surrounds the town, should have been displaced by a railway station."

Along this lofty viaduct, which is more than 2,000 feet long and nearly 130 feet high, lies one of the longest railway runs in the country, namely, the non-stop journey from Newcastle to Edinburgh, a distance of over 124 miles. As the train from the south approaches the bridge and crosses "Tweed's fair river, broad and deep," travellers obtain a fine panoramic view of Berwick and a wide expanse of Border country, with the Tweed, in all its beauty, flowing gently on its way to the German Ocean. Many tourists hail the Tweed as the boundary between two countries, and consider Berwick, situate on the north side of the river, to be in Scotland, but the old Border town is an English borough. The train travels a few miles on the North British lines before it enters Scotland. Thousands of people traverse this famous railway viaduct every year. Many of the trains which cross it are counted among the finest long-distance trains in the world, and bear a striking contrast to what travelling was in "the good old times," when the coach from Edinburgh to London, *viâ* Berwick, was advertised to make the journey in thirteen or fourteen days! The people of Berwick are justly proud of the Royal Border Bridge, and regard it as a wonderful structure. They will tell you that its graceful arches contain over two million bricks, and that people who dispute this number are at liberty to count the bricks for themselves! This massive, many-arched railway viaduct, built of stone, cost £120,000. A passenger train crossing it, when seen from the banks of the Tweed, looks more like a child's toy than one of the great East Coast expresses.

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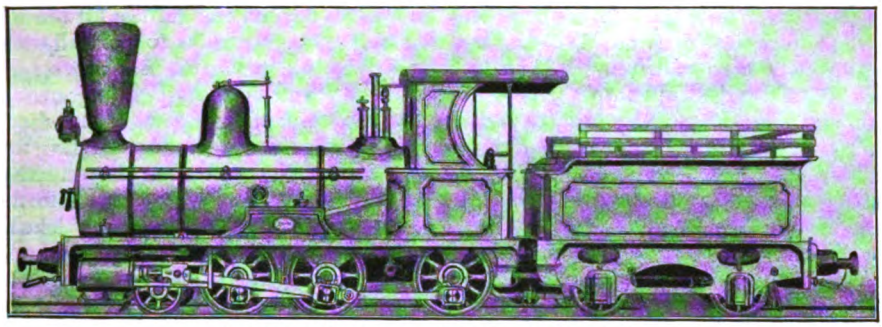

KITSON ENGINE: LIVNY RAILWAY, RUSSIA.
From a drawing specially prepared by Mr. G. F. Tyas.

Leaves from the Log of a Locomotive Engineer [No. IX.].

By ROBERT WEATHERBURN.

PURSUED BY WOLVES IN RUSSIA.

BUT to return to Werchovia, with many apologies for the digression. The peasants were hunted up from the various outlying hamlets where they were passing their time, hibernating chiefly in the foul-smelling atmosphere of their overheated dwellings, begrudgingly bestirring themselves only when the absolute necessities of food and heat compelled. The head men and a few of those who had taken sublets and contracts during the previous summer and autumn, did their utmost both by entreaty, and the offer of double, and even treble pay, to keep them at work clearing the snow, but it was impossible to infuse energy into these miserable beings during the terrible cold spell, and after a time many of them slunk away more like muffled flitting scarecrows than human beings. Day after day the villages were visited with more or less unsatisfactory results.

Another storm, fortunately more localised, again blocked the main line, severed our connection, and left us no other alternative but idleness and starvation—conditions more unpalatable than any other, segregated as we were. This led to an exciting incident which at least constituted a break in the otherwise deadly monotony of our lives. Try to imagine if possible an horizon of frost and snow—snow everywhere, only broken to the far off west by what appeared to be a shaded line. This was the verge of a forest, itself snow-clad, the shaded line imparted by the space between the lower branches and the snow-covered ground. The horrid sameness of this perpetual virgin white, unrelieved by even the slightest variation of colour, seemed to grow upon us, associated ever with a stinging biting cold, rendered more unbearable by insufficiency of food and comforts. In mockery of this great deep wrapping, so silent and emblematical of death, the sun, like a great dull red copper disc, sullenly, grudgingly luminous, sharply defined in the heavens, but without sympathy or warmth or apparent light, seemed by its presence to make the cold more cold. Picture all this and one no longer wonders that the peasant, like the native bear, hides himself in his warm retreat, and refuses to be drawn forth either by bribe or force.

It was on such a day—one among so many, dull, incurious, sickening in its monotony and want of life, intensified by the enforced idleness, all but intolerable to strong men anxious and willing, but frost-bound to inactivity, with no amusements, no resources left, day after day, rarely, if ever, seeing a living thing beyond ourselves, for at this time the Professor and the Count had betaken themselves to more comfortable surroundings—that a stirring episode occurred. It was quite an event when we

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heard the cry of "a sledge" from one of our party who had been wearily gazing over what has erroneously been called the "beautiful snow." We all rushed out into the cold, to see the strange and unaccustomed sight, and there not more than five hundred yards away was a low-trailing structure with three horses attached. On nearer approach, in response to our signals and shouts, we saw the vehicle was of the rudest and most primitive kind. It was constructed of three strong yet slender poles bound together in the form of a triangle or grid, the base of the triangle forming, with the addition of a wooden bolster, the carrying part, the horses were triced on to the apex by means of a tail beam. Over the three poles, and roughly secured thereto, were cross pieces of birchwood all bound together, as also were the poles, by withes of flexible bark. The horses were beyond doubt the ugliest, longest haired, and patchiest looking creatures it was possible to see, while with the long frost tendrils floating from their sides and heads, accoutred with rope harness, the whole "show" was one for which the most speculative of London costers would have hesitated to have exchanged his homely donkey. Yet these were a sample of the justly celebrated Elitski breed, renowned throughout the whole Russian Empire. Their virtues were hidden under rough winter coats, which had never been disturbed by the shears and the curry comb.

The peasant driver was thoroughly in keeping with his menage—low-browed, sunken-eyed, long matted hair surmounted with a towzled half turban, half fur cap, the frozen breath congealed in icy pendules hanging from his moustache and beard, dressed in a rough greasy sheep-skin which had probably done duty for two or three generations, belted at the waist with what might have been twisted leather or rough spun material, curious, but suspicious and yet speculative, with no recommendation but his ill looks. With some difficulty, we made him understand (he being a Staroi Russ) that we wished to engage him to take us to the nearest place where food could be obtained, at the same time arousing his cupidity by showing him a small packet of paper roubles. Then for the first time he showed avidity, and offered for a couple of roubles to take us to the village of Wasili Ostroff which according to his account was a veritable land of Goshen.

There was no further parley. Three of us donned our thickest coats and bemuffled ourselves beyond recognition for the journey, taking the precaution to partially load the revolvers we had. To seat ourselves was a difficulty, and no more painful journey could have been made in a semi-civilised country. The sledge, improvised of the roughest materials, afforded no seat beyond the short timber or wooden bolster which formed the base of the triangular structure. The back to lean against was flimsily composed of a few stout sticks lashed to the poles and bolster. Thus, with legs stretched out, for no other position was possible, and in happy ignorance of the geography and locality of Wasili Ostroff, knowing only that the name was the same as one of the islands of St. Petersburg, we dashed off at a speed that nearly upset us in a flounder. Soon the change and novelty infused exhilarating life into our blood, and we were for a time redundant of spirits.

We had several unpleasant spills owing to the sledge striking some projecting tree stumps, but after what at length became an almost unbearable martyrdom of cramped position and cold, we arrived in the uncertain light of a rapidly failing day at a cluster of huts. Not for one moment did we suppose they were inhabited, all being as still as death itself, only one solitary dog gave an alarm, which speedily subsided into a howl as it vanished in the snow. Drawing up with the peculiar purr alongside a larger and more imposing mound of snow, with a dirty capped top, which proved on nearer examination to be a dwelling, our driver jumped off, and proudly uttered "Wasili Ostroff." Even then we did not realise the presence of an inhabited village, but, leading the way, our driver went on his hands and knees, and crawled downwards into the interior, we following. I have always been a lover of fresh air. Even the confined cabins on board ship were objectionable when unventilated. The transition here was so sudden from the pure keen fresh air, to an atmosphere so foetid with animal smells, and stifling with heat that we gasped for breath, and our native habits revolted at the change.

Amid darkness rendered more uncertain by the discordant cries of the disturbed fowls and pigs, which although not seen, were darting about among our legs, not knowing whether we could stand upright or not, we heard someone in voluble old Russian demand who it was. Our guide mentioned his own name, and explained that he had brought three of the Anglichina from

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Werchovia to buy of his plenty. Much to our relief, the door of the mud-built stove opened, and a dull gleam shot out. A hand reached out from the top of the oven, which served as the family couch, to seize a bundle of long splinters of pinewood, one of which was lighted, and forthwith stuck into the cleft of a short thick stick, which seemed to be a permanent fixture in the clay floor. This formed the only light obtainable, and when nearly burnt out another took its place. It was a relief when the resinous flame lit up the surroundings.

The begrimed faces and dishevelled hair of the four occupants of this unsavoury sleeping berth, were eagerly staring at us in curiosity. Peasant, his wife, and two grown up daughters, were all speaking at the same time. This, with the cackling of the hens, and the squealing of the pigs, which occasionally charged us like dogs, made up as nice a little inferno as could be imagined. In this bewildered condition, half choked with the horrid compound of dust and every malodour begotten of filth, flesh and fowl, blended with a sickening heat, we succeeded, after some little haggling, in buying the largest pig, which seemed to us to be more of the greyhound than anything else, with head so long and snout so sharp as would have enabled it to " hunt a nut from the toe end of a Wellington boot." The purchase money—three roubles—included a dirty sack of rough material into which the protesting " porker " was placed, and tied up as well as means would allow.

Once more in the open, profoundly thankful and relieved, we took in copious draughts of the sweet, but terribly cold air. The pig was placed on the sledge grunting his dislike of the change. Enjoining on our driver speed, and a quick return, we took our places more constrained for room than before, our legs across the bag containing the pig, which also checked his movements to get free. The evening was now far advanced as over the pathless snow we sped, with that peculiar soft gliding motion which no other mode of conveyance can equal—in what direction we knew not, trusting implicitly to the guidance of the stolid looking driver. There were no landmarks to guide us, but there was no indecision on the part of our man.

The night shades were giving way to a brilliant moon as on we sped, without a vestige of life or dwelling to be seen, our arms linked into each others, no unnecessary precaution, as we had already found to our cost, for more than once on the outward journey we had been rolled off by the undulating, and side swinging movements of the sledge over the hillocks, and rough places. Through the frozen surface of the snow, in many places several feet deep, one of the horses would occasionally break, when, with benumbed hands and feet, we had to assist the driver to extricate it. At last we sighted a forest, the margin of which we skirted for some considerable distance. But here the travelling was by no means so pleasant as on the open plain. More than once the sledge struck against a projecting stump or snag, the shock throwing us over—a laughing heap on the snow while the horses, momentarily relieved of their human freight, sped on for a time until pulled up, causing us to run as well as our benumbed and cramped feet and legs would permit. Our " captive " would at such times give vent to his displeasure by loud squeals, which were carried far and wide on the still night air.

Several times I had noticed the driver look anxiously around as though in doubt or apprehensive, and the horses, hitherto tractive and obedient, began to jib after a fashion that tried the patience and skill of the driver, causing him to use a few expletives seemingly meaningless yet peculiarly eloquent in the Russian tongue. At last one of the offside horses, in a vain endeavour to jib, floundered through the snow crust where the depth was probably not more than eighteen inches with the usual result of a spill. The driver no longer chaffed us dryly, and was no longer an unemotionless being.

Something in his look and hurried action caused us apprehension, and while adjusting myself on my most uncomfortable seat—being one of the outside and the last to be seated—I curiously gazed backward in the vast covering of snow fringed on one side by the deep shade of the snow clad forest. I noticed a couple of what for a moment I thought were donkeys emerge two or three hundred paces away, their dark forms strongly outlined and magnified by the setting of snow.

In amazement, I called the driver's attention to the strange comers. One quick glance on his part was sufficient. In a moment the fellow changed. In place of a stolid, apparently stupid, cringing brute, the true emergent man arose. With a sharp cry of " wolka, wolka," he left the frail made seat on which he was sitting, and

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standing with legs apart, one foot placed on each projecting end of the crossed triangle of poles, he gathered the rope reins to a sure and controllable length in his left hand, urging the horses by voice and gesture, encouraging them by words of endearment unknown to any other horseman. We dashed ahead at a rate that at any other time would have been thought terrific. The hulking, ugly, rudely clad figure, seemed to disencumber itself from its unsightly habiliments, and to become positively heroic. No longer the submissive serf-like embodiment of ignorance and cupidity, but the presiding genius of the struggle for life and safety. Our absolute reliance on him dwarfed and belittled us. The tangled masses of his unkempt hair streamed, rose and fell from under his dome-shaped hat. No Roman charioteer ever showed to greater advantage in the most palmy days of Nero or Vespasian when struggling for the amphitheatrical prize. Here there was no stimulant of ardent and desperate rivalry, no applauding crowd, only the wild waste of snow beset with countless millions of sparkling gems of frost, and the calm cold orb of night with the myriads of stars gazing down on the race for life.

Every now and then the driver cast a furtive glance behind. By his renewed exertions and entreaties to the horses we knew that we were being pursued by the wolves. He coaxed, entreated, and exhorted his team to do their best, called them by the names of mother, brother, sister and sweetheart, encouraged them by lavish promises of "*chorni*" and "*bali klap*" (black and white bread) if they would only carry us through safely. The clumsy and fragile made sledge seemed to bump, glide and swirl, as it glissaded with its living freight desperately holding on, escaping we knew not how from being spilt, with arms linked, the two outside clutching and holding the frame work with tightened grasp, giving us no opportunity of defending ourselves even had we been properly armed. Meanwhile the pig squealed its utmost, and its sounds had no doubt attracted the wolves.

We had lived long enough in Russia to know that unless forced by hunger, they rarely attack singly or in pairs. What we feared was the arrival of the pack, and our fears were increased as we heard the half howl, half yelp calling on stragglers or the pack to assist in the hunt. The horses appeared to understand the danger, and were at their full stretch. Even under these exciting conditions, we were filled with admiration at the matchless display of horsemanship shown. How the driver maintained his footing was a wonder—leaning forward as though he intended to spring on the back of the middle horse, he would the next moment crane himself to the left or right to admonish the outsiders, "taiconka brat, be careful good brother thou shalt have kisses, galore," his elf locks flung over his shoulder as he looked back—we realised the qualities of the man. How the terrible pursuers kept so closely on our wake I never could understand; but at last a cry of triumph escaped the lips of our Jehu, and with a wild exultant yell, followed by taunts of derision, as he looked back, he told us we were safe.

But it was not until we had gone nearly half a verst further that we realised his meaning. Straight ahead we saw the dark outlines of a snow-clad dwelling palisaded around. To this we flew for shelter. A huge wicket gate secured by a swinging cross-bar prevented our entrance; but in a short time in answer to our cries, half sleepy forms appeared, and we were admitted to a sort of caravanserai, half farm-house, half Traktir. Our pursuers slunk away in the distance, for at best the wolf is as cowardly as it is cruel, and we spent the night smoking, and partaking of vodki until morning. Our host informed us that one of his men had been missing some days, and that a watch dog had been devoured the week previously. At ten in the morning we resumed our journey to Werchovia, at which place we arrived much to the delight of our colleague, who had spent an anxious night by himself. When assured of the danger, our driver had fortunately made for safety in a somewhat different direction.

After several experimental trial runs with both classes of engines—the double and single bogie types—in some instances under the most trying conditions of weather, the line was sufficiently cleared of snow to permit of our running as far as the great trestle bridge, the first of its kind in Russia, which spanned a deep gulch or ravine at a height in the centre of 120 ft. above the lowest dip of the valley.

At that time the bridge was unfinished, the footway platform not having been laid. Single planks used for the convenience of laying the rails remained covered with snow. The gauge of the rails, as formerly stated, was 3 ft. 6 in., and the free platform

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was a metre more on either side without balustrades or protection of any kind, so that when passing over a clear view of the beams, struts and spars to its sheer depth could be obtained. Without, so far as we could ascertain any proper examination of the rails and their fastenings having been made, it was decided by the authorities on the spur of the moment that the smallest of the engines should pass over. The Russian driver who had been appointed to learn the management of the engine, was ordered by the Count to take charge and proceed slowly across; but, with more prudence than his chiefs, he hesitated, and humbly suggested that as the bridge appeared very flimsy, two pulleys should be fitted one on either side of the awning of the cab, ropes passed through and fastened to the regulator handle, thus like a horse with leading reins to be manipulated safely from one end of the bridge. The proposal met with a storm of abuse from the Count, and he hurled all the uncomplimentary imprecations that abound in Russian upon the poor fellow, who at once grovelled at his feet, and tried to kiss his boots but was spurned away.

Then his Excellency with dignified suavity, and in choice English, asked me if I would take the engine across and back again; if so, he would accompany me. I agreed, and I venture to think that in doing so, with my better practical knowledge of the hazard we ran, I underwent a much more severe test than his Excellency. We proceeded slowly and steadily, the timber structure, with the sudden accession of weight, cracking at times as though it had been struck by a heavy hammer. In any other country, with the most stable material under our feet at such a height, it would have been considered a severe test to the nerves. In the unfinished state in which it had been left—with a total width at the top of not more than 10 ft. at the most, a yawning gulf on either side and between the sleepers—the prospect was anything but cheering.

A sharp crackling sound of the timbers, tremors and distinct swaying of the huge structure, were anything but reassuring. The total length of the structure with approaches was 1,010 ft., and when half way over, I noticed a large rope lying frozen across the rails. Owing to the overhang of the engine, there was but little room to get off and walk on one side to remove it. I, therefore, ran the head of the engine as close to it as possible, and walking round the footplate to the front, with difficulty dislodged it from its frozen grip of the rails. We then proceeded across, and were followed by the heavier Fairlie engine. We were afterwards informed that a very cursory examination of the bridge revealed the fact that hundreds of nuts had never been put on the bolts used to fish the spars together, and that scores of other bolts had not been driven home. The Count was heartily congratulated by his staff on his successful issue, and measures were afterwards taken to punish the sub-contractors for their culpable negligence. Indeed, it was the opinion of the experts that the rigidity of the bridge during the test was due to its being firmly frozen at the splices. Several men were employed for weeks after in screwing up the bolts solidly, and renewing hundreds that were defective.

However, his Excellency marked his appreciation of our conduct by making each a present of a beautiful gold watch, "as a tribute," he said, "to the devotion to duty shown by Englishmen." Our return journey —tender first—to Werchovia that night was a terribly cold ride. Dreariness and discomfort were greatly increased by the dust-like particles of snow raised by the wind, which beat in our faces forcing its way into our nostrils and eyes, compelling us to disregard hearing and sight, by turning our backs and making a funnel of our huge coat collars to keep out the insidious and stinging particles. In our haste, we ignored the injunctions not to exceed a speed of 10 miles per hour, as the sleepers were well known to be resting in many places on snow alone. We hurried up hill and down dale, sweeping round the most severe curves at little less than 20 miles, and many a violent lurch caused us the most lively apprehensions. Our desire was to get back with the utmost celerity to our rude, but warm, quarters at Werchovia, and when eventually we ascended the last gradient leading up to the depôt, it was with feelings of profound relief.

The engine was without delay put into the shed, the boiler and tank filled up, the remnant of the wood fire was left burning. We hurried off to shelter, and after partaking of such food as was obtainable, with a basin of tea minus milk or sugar, we were soon fast asleep in our humble "shakedowns." We had not been more than two hours at rest before we were hastily summoned to get our engine out again, and proceed to the assistance of the double

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Fairlie, which had run short of water some four miles away. It was fortunate that we got there, for nearly the whole of the staff were riding on the engine, and without water meant to be without fire, which in such weather was intolerable. We found the whole party demoralised, and engaged in doing their best with only two shovels to fill the side tanks with snow, which was being thawed by means of blowing the steam back through the injectors. This tedious operation was speedily dispensed with, and we hauled our unfortunate comrade back, and had him stabled by midnight.

Our work was now at an end, and as the small tender engines were ordered to be stabled at Livny in readiness for the opening of the line when the Spring set in, this was a sort of holiday trip before returning to the Baltic provinces and civilisation, and great was our satisfaction to find that the Government had made better provision than we expected. Livny, something of a compromise between a large village and a small scattered town, was laid under requisition for sleeping accommodation, and a colleague and I were provided with a straw "shake-down" on the hard, trodden earthen floor in a well-to-do peasant's house, sharing the same room with the husband, wife and baby. The provision for the latter was the most original imaginable. Directly over the mud oven on which the peasant farmer and his wife were sleeping there projected the end of an elastic sapling or pole, the other and thicker end of which was firmly secured into the flooring, like a fisherman's rod when left to itself. The angle of the rod was such as to allow of about 2 ft. above the faces of the parents. A birch wood cradle was fastened thereto. By the uncertain light of a badly trimmed lamp we could see that whenever the baby became restless, and began to cry, the mother would reach out her hand and grasping the cradle pull it quickly down, and as suddenly release it, thus imparting a series of jerks or up and down movements of the fishing-rod like contrivance.

On the following afternoon, a Government sledge was provided to take us back to Werchovia. The sledge was a good substantial affair, with a litter of straw for our feet and a well-worn bear skin for our knees. There were only two horses, but they proved excellent, and thus we started off on the best of terms with ourselves. It is difficult to convey the mingled feelings inspired by a sledge ride under conditions so peculiar to ourselves. Ordinarily it is the most sublimated style of travelling where there are good roads, varied scenery and the occasional Traktir for warmth and refreshment. In our case the weather was more than usually severe, with an exasperating bite that seemed to strip the nose and cheeks, making us "duck" our heads to mitigate its force, and to avoid the snow pellets that were flung from the horses' frogs while galloping—no beaten track, but a mighty unbroken plain, a sea of snow, of pure glittering white, oppressive by reason of its terrible sameness.

A long and trying experience of five months duration, of continuous and unbroken snow, made it horribly monotonous, particularly in a country entirely unknown to us, and with an absence of everything that makes a sledge journey pleasant, and the presence of nearly everything which makes it disagreeable—too cold even to talk, the oppressive silence only broken by the peculiar whistling sound of the sledge runners, and the rhythmic almost indistinct thud of the horses' feet, mingled with the faint but interminable tinkling of the small bells which formed the ornamentation of the horses. An occasional grunt of displeasure from the driver at being requisitioned on such a night provoked from us the single word "davai" or "skurry" ("Get on"). After travelling some considerable distance, the driver eased up, and, turning his capoted head, blandly inquired whether there was no wodka to be had, as he felt the cold severely? We certainly did not feel inclined to pass our flask containing the last of our carefully preserved cognac to his ice-bearded lips. He then pointed with his short stocked whip to a direction a little to the right of our running, and suggested our calling at a farm house, where he was sure that something comforting in the way of tea or wodka could be obtained. Feeling the need of something warm, as our feet were without animation, we gave him permission, and in a short time, a large snow-clad house seemed to rise from the plain.

A few blows on the door and the barking of dogs brought the owner, and after a short explanation, we were invited to enter the vestible, and thence into the main room. Sudden change from the bitter cold outside to the almost overheated room was an inexplicable relief and pleasure to our benumbed limbs. The apartment was the most comfortable we had seen for many

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weary months. A rude settee covered with sheep and wolf skins formed a most comfortable and, to us, luxurious resting place; a solitary table stood in the centre. The Iconast fixed in the corner with its flickering sickly light, and the pictures of half-a-dozen saintly personages formed with other simple and unpretentious articles, the only furniture. A Russian farmer is never averse to turning an honest rouble, and, in lieu of waiting for the Samovar, the Achisni Wodka was brought out for myself and colleague. The driver preferred (as I knew he would) the raw and fiery spirit, which is so commonly drunk by the lower classes. After filling our *Malinki Rumpki*, or small glasses, the driver begged for a *bolshoi stekan*, a large tumbler, for himself, which, with some reluctance, I allowed him.

Saluting the Iconast with many fervid gestures and mutterings, he swallowed the fiery spirit almost at a draught, and heaved a profound sigh of pleasure. Loth to leave such comfortable quarters, we prolonged our stay by conversing with the landlord, who put many questions regarding railways and locomotives. Of neither had he ever seen a specimen. When rising to depart, I found that my good-hearted colleague, yielding to the entreaties of the driver, had filled his glass a second time, and before I could interpose, it had as speedily followed the course of the first. I was naturally much alarmed at the consequences of such an indiscretion, although our Isvostchik assured us that he would not be one wit the worse.

Reluctantly we bade good-night to our amiable host, and heard the lumbering cross-bar fall, as once more taking our seats, we felt ourselves outcasts for a time. The driver certainly made magnificent headway, judging by the speed of his horses. How long the effusive spurt lasted I cannot say, for with bowed heads we sought to protect ourselves from the occasional concreted snow clots which, flung from the horses hoofs, were capable of inflicting great pain if they struck one in the face. But shortly afterwards we became conscious of something slow and purposeless in the movements of the sledge. One glance sufficed to explain the reason. The driver, overcome by the potency of the spirit, and exposed to the sudden change from heat to cold, had unmistakeably fallen asleep, and, judging by the way in which his head lolled forward nodding, swinging listlessly from one side to the other, he had been so some little time. In a moment we both realised the extent of our danger. To sleep in such a cold is death, and without the driver we ourselves were but as helpless waifs on the great trackless snow plain over which we were passing. Worse still, the driver falling asleep had inclined to the right, and had, unconsciously, tightened the reins in that hand. So that for some time the horses had been moving in a semi-circle, but how long we knew not.

The oppressive death-like solitude, with no dwelling place, tree, or living thing in sight, impressed us painfully, and aroused us to the immensity of our danger. But neither shouting, shaking nor tugging were of any avail. Every moment was increasing the danger, and we then had to resort to what might be thought brutal measures. With our gloved hands we "clouted" the driver on the cheeks, the violence of the blows sending his head from right to left. We punched him in the ribs and back in the most merciless fashion, without any response, for so long a time that hope almost deserted us. We battered him again and again, and at last a protesting groan was heard. This encouraged us still further, until our inhuman exertions were rewarded by a wild, vapid, senseless stare. Again we buffeted him about the cheeks until he found voice enough to moan out his protests, which increased under the continued assault and battery. Nature and fear together brought out the cry of "Caramanjiks" (thieves); but we continued shaking him with an occasional buffet, enough to loosen his teeth, until he at last realised the situation. He had, however, completely lost his bearings. There was no beaten road to follow, and eye could not discern the track by which we had come, the white veil of snow having destroyed all trace of the sleigh runners.

When the full situation revealed itself to his gradually dawning senses, he wheeled the horses round once or twice perplexed or undecided, and, loosing the reins, allowed them their own course—a liberty of which they at once took advantage by instinct to return whence they had come, once assured of the homeward course. The driver regained control of the reins, and wheeled them round again in the opposite direction, showing that he at last comprehended what was required. For the next half hour we were in a state of supreme anxiety and suspense. He then grunted out a sign of recognition. Pointing to the left, he veered

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slightly to the right and, on straining our eyes in that direction, we thought we caught a glimpse of an occasional telegraph pole alongside of which we sped at a wild gallop for another half hour. At last we were drawn up safely before the snow-clad hut at Werchovia.

In his last contribution the writer expressed regret at not being able to supply a photograph of the Kitson engine which competed against the *Fairlie*. Since that time, by courtesy, he has had an opportunity of making a rough pencil sketch of the outlines of the general design of these engines. The pencil sketch, with the principal dimensions, were sufficient to enable Mr. G. F. Tyas—to whom the author desires to express his indebtedness—to furnish at very short notice the singularly accurate sketch shown at the head of this article. In the May number these engines were inadvertently described as four wheels coupled, instead of six wheels coupled. The general dimensions of the Fairlie engines built for the Imperial Livny Railway by Messrs. Sharp Stewart & Co., were as follow :—

Four cylinders 13¼ in. dia. by 18 in. stroke.

Two six-wheeled steam bogies, each with wheels 3 ft. 3 in. dia., and 7 ft. 6 in. wheel base.

Boilers 3 ft. 4¼ in. dia., 10 ft. 6 in. long, each barrel with 246 1¾ in. tubes.

Heating Surface :	Fireboxes	115 sq. ft.
	Tubes ..	1325 ,,
	Total	1440 ,,

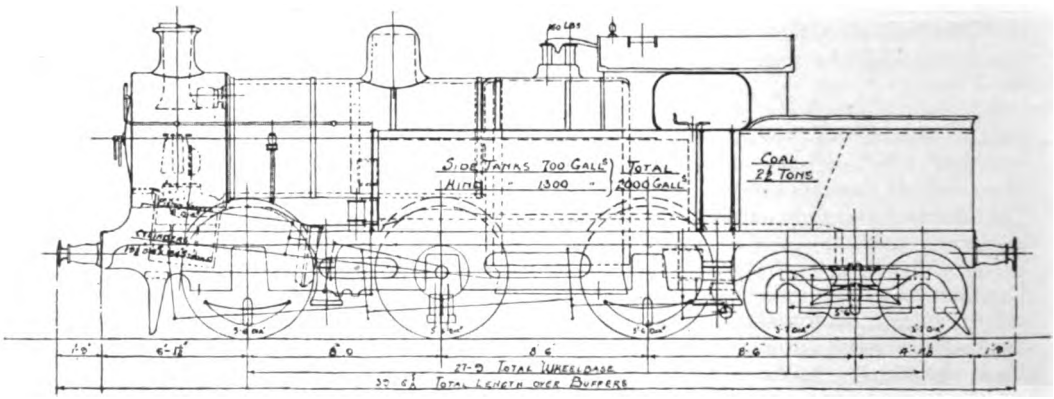
Grate area 21 sq. ft.

Capacity of tank 1,250 galls.
Bunkers 200 cubic ft.

Weight empty 36 tons 15 cwts. 2 qrs. Full about 43 tons (see *Engineering*, November 10, 1871).

Mr. Weatherburn's next Contribution will appear in the July issue of the "Railway Magazine."

New Superheater Tank Engine: South-Eastern and Chatham Railway.



IN order to meet the very heavy requirements of many of the local services in and out of Charing Cross and Cannon Street during busy hours, Mr. Harry S. Wainwright is placing in service five 0–6–4 tank engines fitted with Schmidt superheaters. As will be seen from the above diagram, the design is a development of the larger 0–4–4 engines already in use, but with increased boiler dimensions, a larger bunker, and other changes. The cylinders are inside the frames, and fitted with piston valves above, operated from the link motion through a rocking shaft. In conjunction with the Schmidt superheater a reduced steam pressure is adopted. The firebox is of Belpaire type, a novelty as regards the tank engines on this line. Leading dimensions are as follow: Cylinders, 19½ in. by 26 in.; piston valves, 8 in. diam.; coupled wheels, 5 ft. 6 in. diam.; bogie wheels, 3 ft. 7 in. diam.; coupled wheelbase, 16 ft. 6 in.; total wheelbase, 27 ft. 9 in.; length over buffers, 39 ft. 6⅝ in.; steam pressure, 160 lb. per sq. in.; water capacity, 2,000 gallons; coal capacity, 2½ tons; weight in working order, about 70 tons.

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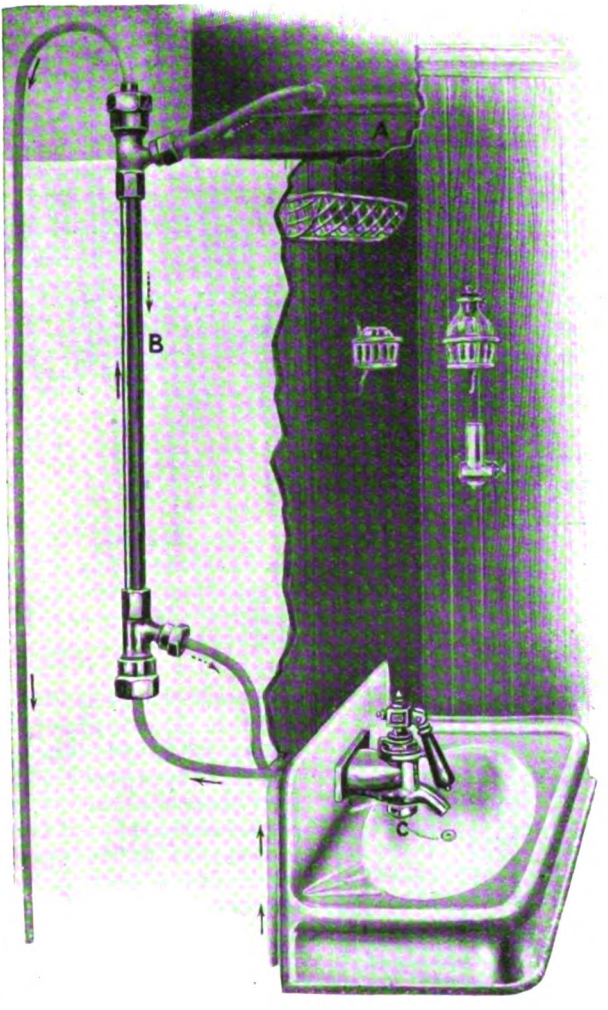
Some New Westinghouse Specialties.

A booklet has been issued by the Westinghouse Brake Company, Ltd., explaining their patent system of steam heating for railway carriages. This apparatus has already been described in detail in the RAILWAY MAGAZINE, but reference may now be made to a new design of heater for supplying hot water to carriage lavatories. Illustrated in Fig. 1, the installation comprises a special tap C, and two concentric vertical tubes, the outer of which, B, is seen in the photograph. Cold water passes from the reservoir A between the outer and the inner vertical tube, and in the direction of the dotted arrows into the tap C. When the tap is in the intermediate position, no water can pass through, but when the handle is turned to one side, cold water flows into the basin. When the handle is turned to the opposite side, steam passes from the main heating pipe, in the direction shown by the full arrows, through the inner of the two concentric vertical tubes, and thus to the atmosphere. This heats up the water flowing down in the space between the two vertical tubes to a temperature of about 104° Fah. The steam does not come into contact with the water, therefore, as the water does not issue from the tap under pressure, no escape of steam into the lavatory can take place. This apparatus, simple and compact, obviates the necessity of providing a hot water tank, with its attendant disadvantages.



WESTINGHOUSE WATER HEATING APPARATUS FOR RAILWAY CARRIAGE LAVATORIES.

The same firm is introducing a self-regulating ejector for automatic vacuum brakes. This has been designed to quickly and economically create a normal vacuum for vacuum brake service, and to maintain it with about 110 lbs. steam pressure. It has been assumed that the pressure of steam in the locomotive boiler will usually be in excess of 110 lbs. per square in., and a steam pressure reducing valve embodied in the ejector, is set to reduce the steam pressure to about 110 lbs. per square in. before delivery to the ejector nozzles. The principal features in the design are: (1) In the place of one large steam jet several small jets are used, which give greater economy in steam consumption; (2) the air for applying the brake is admitted by a valve of the poppet type, which remains

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seated and unmoved during all movements of the ejector handle, except that for applying the brake; (3) the provision of the automatic regulating valve, whereby the pressure of the steam supplied to the ejector is maintained constant. The following advantages are claimed: (1) uniformity of vacuum obtained with variable boiler pressures; (2) uniformity of brake power; (3) absence of brakes creeping on; (4) absence of failures to release brakes owing to vacuum created by the ejector of one locomotive being greater than that obtainable by the ejector of another locomotive; (5) rapidity of action in production of vacuum, and (6) economy in steam consumption. Three types of ejector are made: (1) with internal steam and exhaust pipes; (2) with external steam pipe and internal exhaust pipe; (3) with both pipes external. All are made right or left hand, with or without flange for steam brake valve. For cases where the space available does not allow sufficient room for the standard type of ejector, an ejector can be furnished with its automatic regulating valve detached from the body of the ejector proper.

Figs. 2, 3, and 4 show the ejector in section. The body 1 is bolted to the distance piece 59, which is attached to the firebox front, or to a

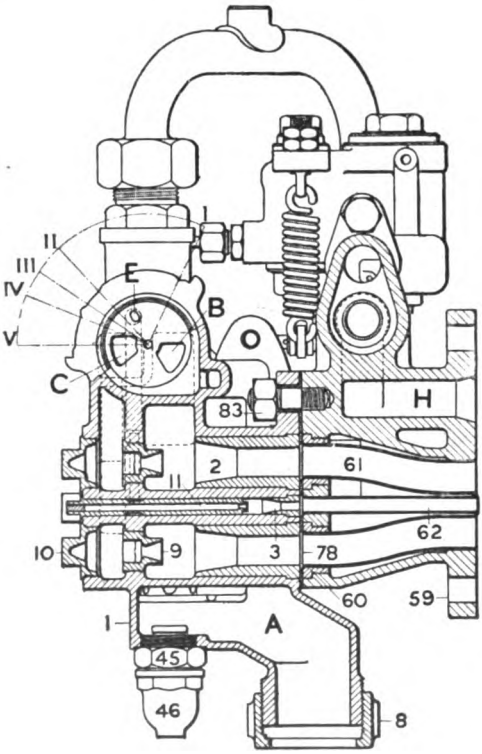

FIG. 2.

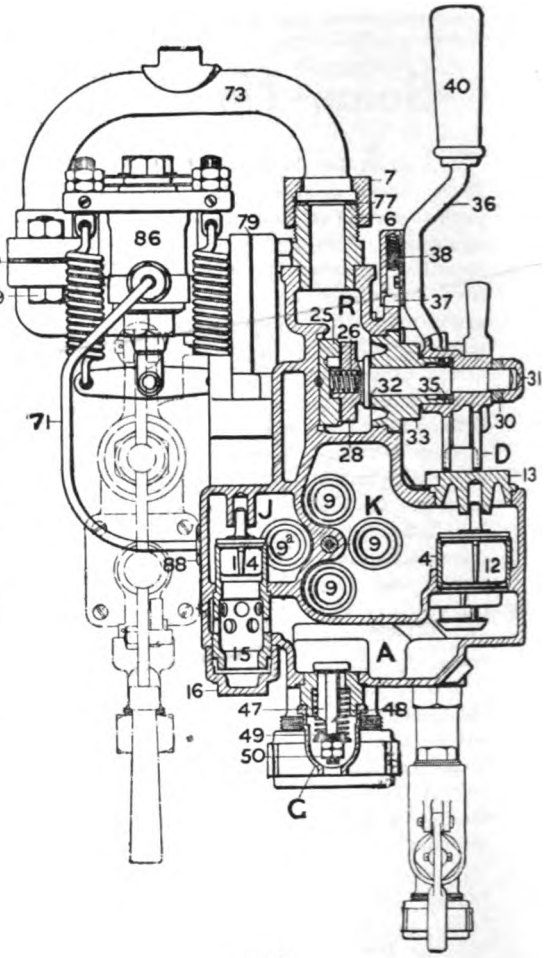

FIG 3.

supporting bracket in the case of the ejector with both external pipes. There are four steam nozzles, 9-9a, with their combining tubes 2. The nozzle 9a is placed in a chamber separated from that in which the three nozzles 9 are placed, and exhausts the air from the passage A connected to the train pipe through the check valve 14, whilst the nozzles 9 exhaust the air through the check valve 12. The small nozzle 11 and its combining tube 3 are supplied with steam through port E, when the ejector handle is in position V, and the brake is fully applied. Combining tube 3 is connected at F, Fig. 6, through a pipe to the vacuum-chamber side of the piston of the brake cylinders on the engine and tender. Check valve 53 intervenes and ensures that the vacuum on the upper side of the pistons is fully maintained when the brakes are applied. If it be desired to release the brakes on the engine and tender only, this can be effected by means of the handle 55,

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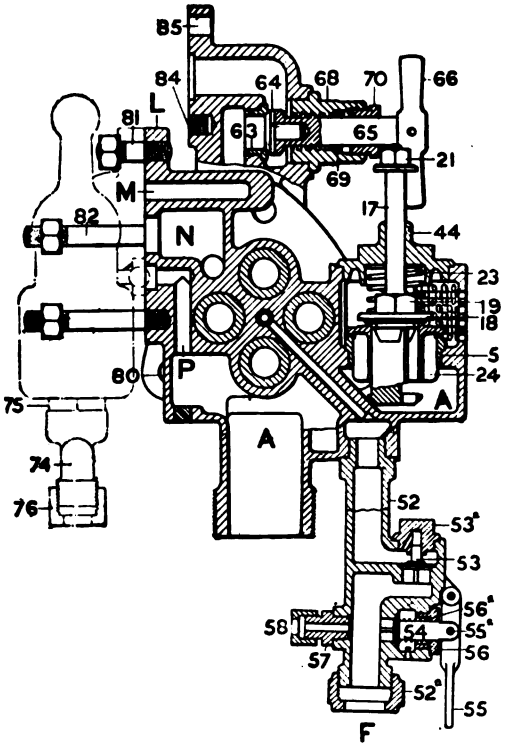

FIG. 4.

which unseats the valve 54, and admits air to the upper side of the brake cylinder pistons. Valve G is for the purpose of regulating the maximum degree of vacuum. If the vacuum increase above the point to which the valve is set, the valve lifts, and allows air to pass into the passage A. This device consists of a casing 45 with a valve 47. The valve is held on its seat by the spring 48, the compression of which can be regulated by the nuts 50. A cap 46 protects the parts from interference, and should it be desired, for any reason, to cut out this valve, provision is made for a plug to be screwed in the bottom of the cap. The automatic regulating valve is carried on the distance piece 59, and connected to the ejector by pipe 73. For the ejector with internal steam and exhaust pipes, a steam cock, consisting of parts 63-70, is placed in the passage H leading from the locomotive boiler to this valve, but, for ejectors with external steam pipe, a steam valve is mounted on the boiler shell. All ejectors can therefore be removed whilst the boiler is under steam. When the ejector is required to work in conjunction with the steam brake valve, a flange L with the necessary ports is provided to carry this valve. Steam is taken from the steam passage, at R, and passes through the passage M to the steam brake valve and thence to the steam brake cylinder, and exhausted through the cavity N to the ejector exhaust pipe. The application and release of the steam brake is automatically controlled by the variations of pressure in the train pipe, communication between this pipe and the controlling device being established through passage P.

There are five principal positions of the ejector handle, namely: (1) full release, (2 & 3) running position, (4) lap, (5) full application, and the action of the ejector is as follows: The ejector handle 40 being in the full release position, 1, the steam valve 25 opens the steam supply through ports B-C to the four nozzles 9 and 9a, and a vacuum is created in the chambers J-K, into which the air from the train pipe exhausts through the passage A and check valves 14 and 12. When the desired vacuum has been obtained, the handle 40 is placed in the running position between 2 and 3, which cuts off the steam to the three nozzles 9, but allows it to flow through port C to nozzle 9a. The check valve 12 remains shut, but the single nozzle 9a continues to exhaust air from the train pipe through the check valve 14. The supply of steam to the nozzle 9a is regulated, as may be necessary to maintain the desired vacuum, by moving the handle between positions 2 and 3. When the handle is in position 4, the supply of steam to all the nozzles is completely shut off, and the ejector is on lap. As the handle is moved towards the position 5, full application of the brakes, the claw D engages with the collar nut on the top of spindle 17 (Fig. 6) and lifts the smaller valve 18, which seats on the centre of the larger hollow valve 25, admitting a certain quantity of air to the train pipe through passage A, and partially applying the brakes. After the smaller valve 18 has lifted some distance off its seat, the collar at the bottom of that valve engages with the larger valve 24, lifting it also off its seat, and allowing the air to pass very rapidly to the train-pipe, thus fully applying the brakes. The spring 23 serves to retain the valves on their seats. By this arrangement, the valve 18, which is of small area but of sufficient size to admit air for ordinary service applications of the brake, can be lifted by a comparatively small effort, and it is only necessary to make use of the second valve 24 for full or emergency stops. These valves are easily accessible, and are quite distinct from the steam valve 25 which, as the erector handle approaches position 5, admits steam to the small nozzle 11 through port E, and maintains the vacuum on the upper side of the pistons of the engine and tender brake cylinders.

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The New Chief Goods Manager of the Caledonian Railway Company.

Photo] [*Warneuke, Glasgow.*

Mr. Duncan Cameron.

MR. DUNCAN CAMERON, who has been appointed to succeed Mr. Matthew Waddell as Chief Goods Manager of the Caledonian Railway, is already well known in railway circles, having occupied the position of Assistant Chief Goods Manager during Mr. Waddell's tenure of office. He entered the service of the Caledonian Railway Company at Buchanan Street Station, Glasgow, and after being employed there for some years he was transferred to the General Goods Manager's Office. Passing through various divisions, Mr. Cameron was for a number of years, Chief of the Claims Department. He, therefore, takes up his new post well equipped by knowledge and experience for the duties attached to it.

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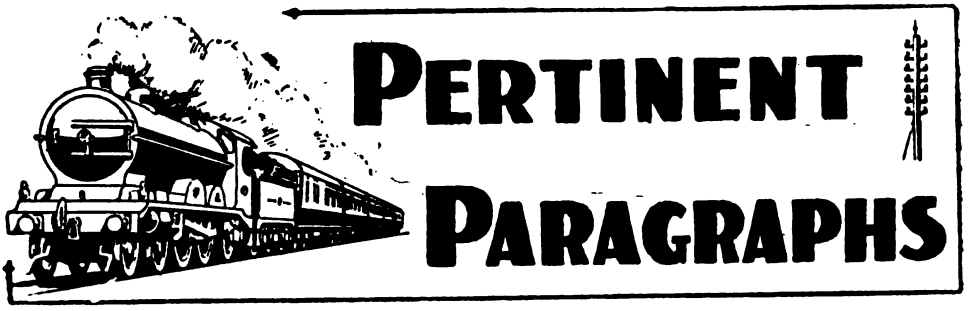

Lord Claud Hamilton.

THE impending retirement from the House of Commons of Lord Claud Hamilton will, we are certain, be deeply regretted on both sides of the Chamber. The second son of the late Duke of Abercorn, Lord Claud Hamilton was born in February, 1843. He has therefore already entered upon his 71st year. His career has embraced military, Ministerial, and railway fields of labour, and in each intense earnestness, courage, courtesy, and an unfailing sense of duty have with him ever been distinguished characteristics. After leaving Harrow School, he served for five years in the Grenadier Guards, and was at later periods hon. colonel of the 5th Battalion Royal Inniskilling Fusiliers and *aide-de-camp* to Queen Victoria. His first appearance at Westminster was in 1865, when he was returned for Londonderry. He represented that city for three years, and in 1868 was appointed one of the Lords of the Treasury in Mr. Disraeli's first Government. Failing to secure re-election at Londonderry, he contested Brecon unsuccessfully in the following year, but was immediately afterwards returned for King's Lynn. He sat for this constituency until 1880, when he transferred his services to Liverpool, and remained one of its members until, in 1888, he temporarily abandoned politics, and devoted himself to railway work. But knowing the great value of his Parliamentary services, some of his friends induced him, in January, 1910, to accept nomination for South Kensington, for which division he was returned by a majority of more than four thousand votes. Since that time he has been regarded as the most influential representative in the House of Commons of the railway interest. His advocacy has always been courageous, and members will not easily forget his indignant outburst against the Government when it seemed as if they intended to acquiesce in a violation of the promise which induced the railway companies to make concessions that brought to a speedy end the strike of August, 1911. Happily, as pointed out in the RAILWAY MAGAZINE, the House of Lords came to the aid of Ministers, and by deleting the clause which proposed to restrict the operation of the Railway and Canal Traffic Act to five years, enabled the Government to keep the engagement into which they had entered. With characteristic frankness, Lord Claud Hamilton at once withdrew the severe condemnation he had pronounced, and there the matter ended. We are glad to add that his lordship has no intention at present of resigning the chairmanship of the Great Eastern Railway.

* * *

Railway Rates.

THE decision to increase railway rates all round to the extent of 4 per cent. from the 1st July next was adopted at a very large meeting of the general managers and secretaries of the railways of the United Kingdon, held at the Clearing House on Friday, April 25th. Authority for such an advance was given by the Railway and Canal Traffic Act of last session, the second section of which provides that—

"Where on a complaint with respect to any increase (within the maximum) of any rate or charge under section one of the Railway and Canal Traffic Act, 1894, the railway company proves to the satisfaction of the Railway and Canal Commissioners—

(*a*) that there has been a rise in the cost of working the railway resulting from improvements made by the company since the nineteenth day of August nineteen hundred and eleven in the conditions of employment of their staff; and

(*b*) that the whole of the particular increase of rate or charge of which complaint is made is part of an increase made for the purpose of meeting the said rise in the cost of working; and

(*c*) that the increase of rates o charges made for the purpose of meeting the rise in the cost of working is not, in the whole, greater than is reasonably required for the purpose; and

(*d*) that the proportion of the increase of rates or charges allocated to the particular traffic with respect to which the complaint is made is not unreasonable.

"The Commissioners shall treat the increase of rate or charge as justified."

It remains to be seen whether any complaint will be lodged with the Railway and Canal

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Commissioners in respect of the increased rates henceforth to be charged; but no one can seriously suggest that the companies seek to take any unfair advantage of the powers which Parliament has conferred, with a view to enable them to recoup themselves for the increased cost of working directly resulting from the improvements recently made in the conditions of employment on railways.

* * *

Railway Platform Tickets.

Our anticipations respecting the extension of the platform ticket system are already realised in the case of the London and South Western Railway Company, who brought it into operation early last month (May) at Waterloo station. It is calculated that at the new terminus alone the penny henceforth to be charged for the admission to the platforms of persons not holding travelling tickets will annually yield something like £1,500, while if the arrangement be extended—as may be expected—to all the principal stations, it will represent a permanent additional revenue of not less than £95,000. A member of the Railway Companies' Association has supplied our enterprising contemporary the *Daily Telegraph* with the following estimate of what the leading British railways may expect to receive from this new source, and we are bound to add that in our opinion the calculation is not at all excessive:—

London and North-Western	£100,000
London and South-Western ..	95,000
Lancashire and Yorkshire	92,000
Great Eastern	90,000
Great Western	100,000
Midland	100,000
Great Central	89,000
North Eastern	44,000
South Eastern	24,000
London and Brighton	22,000
Cheshire Lines	18,000
North British	55,000
Caledonian	54,000
	£873,000

* * *

Havre Dry Docks.

The working of the Havre dry docks (*Formes de Radoub du Port du Havre*)—referred to in the first article of the present issue—has been in the hands of the "Société Anonyme pour *l'Exploitation des Formes de Radoub du Port du Havre*" since 1st January, 1913. Of this company the principal shareholders are the leading shipping lines and shipbuilding yards of the port of Havre. Composed, of course, of the principal shipowners and heads of building yards, the board has as President Mr. S. Ducrot, Managing Director of the Compagnie Générale Transatlantique at Havre. The Dry Dock Company does not seek to make large profits on dry docking, its object is to procure for ships prompt and economical docking facilities, and to this end it has agreed to a large reduction on the old prices charged. For example, a ship of 1,000 tons pays after docking on the basis of £3 1s. 0d. per day; 3,000 tons £6 2s. 0d. per day, the tariff increasing 18s. per 1,000 tons. These prices are the cheapest in the world. The great advantage of the Havre dry docks is that they are situated in the Eure Dock, which has to be passed by steamers either entering or leaving the harbour. There are, consequently, no very heavy fees for towing ships from their berths to the dry docks as in ports where the dry docks are a long distance from the discharging berths. In close proximity to the dry docks are works for repairs and painting.

* * *

Railways in the Soudan.

The decision of His Majesty's Government to guarantee to the Government of the Soudan the interest on a loan of £3,000,000 for irrigation work and railway extension opens out a prospect which has led some men to anticipate that the success of the enterprise will be not less remarkable than that following the investment of British capital in the Suez Canal. Before the occupation by the Dervishes, there was in the Soudan a population of 9,000,000, but under fanatical rule this rapidly fell to 2,000,000. British influence has, however, already attracted at least a million more dwellers, and Lord Kitchener anticipates that five or six years hence the inhabitants will number 6,000,000. Simultaneously a strong industrial element is being created, and a more extensive system of railway transport is urgently wanted. In 1906 the total exports did not exceed £265,000, but in 1911 they reached £1,400,000. A large proportion of the trade is in cotton, some of which is pronounced to be the finest grown in the world. Railways are required for strategic purposes as well as for commercial development, and it is, therefore, proposed to devote no less than £1,600,000, out of the £3,000,000, to the construction of new lines.

* * *

The New General Manager of the New Zealand Government Railways.

In appointing Mr. Ernest H. Hiley their new General Manager of the State Railways the Government of New Zealand have made a singularly happy choice, and we offer to that gentleman our hearty congratulations upon this signal recognition of the conspicuous merit which he has exhibited during his service with the North Eastern and Great Northern Railway Companies in this country. The son of the late Rev. Walter Hiley, rector of St. John's, Stamford, Lincolnshire, Mr. Hiley was born on

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J. Bacon] [& Sons.

Mr. E. H. Hiley.

Divisional Goods Manager, North Eastern Railway, now appointed General Manager, New Zealand Government Railways.

June 11th, 1870, and educated at Rossall School, Lancashire. His railway career is indicated by the following record :—

Entered service of North Eastern Railway, Accountant's Department, Newcastle-on-Tyne ..	Oct. 1, 1891
Transferred to Office of Superintendent of the Line at York ..	1894
After filling various positions in the Traffic Department at York was Appointed Assistant District Superintendent, Newcastle-on-Tyne	Feb., 1902
Appointed District Superintendent, York	April, 1904
Appointed Passenger Manager (Chief Passenger Agent), Great Northern Railway, King's Cross, London	Jan. 1,1905
Appointed District Goods and Docks Manager, North Eastern Railway, Hull	April, 1908
Appointed Divisional Goods Manager, Southern Division .. (Remaining in charge of Hull District and Docks, and taking supervision also of Goods and Mineral matters in the Southern half of the North Eastern Railway, including Districts of York and Leeds.)	April, 1909
Appointed Divisional Goods Manager, Northern Division, Newcastle-on-Tyne .. .. .. (The Northern Divisional Goods Manager supervises the Goods and Mineral traffic and Docks in the Northern half of the North Eastern Railway, and includes the Company's Docks at Tyne Dock, Hartlepool, and Middlesbrough, as well as the towns of Newcastle, Durham, Sunderland, Carlisle, Stockton, Darlington, etc.)	Nov. 1, 1911

The Government railway lines of New Zealand have a total mileage of 2,800, and are still being greatly extended.

* * *

Locomotive Performance in the United States.

As a rule the records of railway runs published in American journals are conspicuous by the absence of the details which are required to give a correct impression as to the real quality of the work performed, or else the times are stated in a very approximate or unreliable manner. The result is that, notwithstanding the sensational claims frequently advanced, one is in many instances inclined to question whether anything remarkable was actually achieved. It is, indeed, exceptional for an American run to be timed in the exact fashion usual with qualified observers in this country. Special value, therefore, attaches to the following record of a run by a New York Central express between New York and Albany, for which we are indebted to Mr. E. R. Campbell, at present residing in New York. The load was seven cars, approximately 420 tons, and the train the 10.30 a.m. from the Grand Central Terminal station, New York. Leaving at 10.32.30, 125th Street was reached at 10.43.45 (4 miles 17 chains); left at 10.45.05, and after a bad check, involving the loss of about a minute, a stop was made at High Bridge at 10.50.50. Here the electric locomotive was changed for a 4–6–2 No. 3497. Leaving High Bridge the essential particulars of the log are as follow :—

Distance from New York. M.	C.				
7	10	High Bridge ..	dep.	10.55.10	
9	64	Marble Hill ..	pass	10.58.25	
14	49	Yonkers	,,	11. 8.40	a
21	03	Ardsley-on-Hudson	,,	11.14.0	
24	52	Tarrytown ..	,,	11.17.05	
30	21	Ossining	,,	11.21.50	b
40	56	Peekskill	,,	11.39.05	
58	27	Fishkill Landing	,,	12. 3.25	
72	76	Poughkeepsie ..	,,	12.17.30	c
113	74	Hudson	,,	1. 4.40	d
142	20	Albany	arr.	1.37.10	

a—Bad check and dead stop, 2 min. lost.
b—Permanent-way slack for 2 miles, 1 min. lost.
c—Slow through station.
d—Long slow through station and for about 2 miles.

The schedule from High Bridge to Albany is 2 hours 50 min., but 2 hours 43 min. were actually occupied, giving a net time of 2 hours 39 min.—average speed 50.9 miles per hour. Mr. Campbell states that this "run is in no way remarkable, but is a fair instance of ordinary American performance. On the return journey we left 15 min. late, and reached New York Grand Central Terminus 7 mins. early, having done the 142 miles in 2 hours 53 min. with a stop to change engines at High Bridge and another at 125th Street. Engine again a 4–6–2, No. 3495."

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A Famous Inventor.

His late Majesty King Edward paid a just compliment to a great genius when, in addressing Mr. John Saxby, he said: "You have done more than any other man living in the reign of Queen Victoria to save human life." This generous tribute had reference, of course, to the introduction of interlocking railway points and signals, for which that gentleman was responsible. Mr. Saxby spent more than 20 of his early years on the London and Brighton Railway, and the Company gave him £50 as a present when he produced his first invention—a lamp which was at once recognised as a distinct improvement upon all that had previously been in use upon our railways. But real fame and fortune attended Mr. Saxby when, in 1856, he completed the simple and ingenious contrivance which established purely mechanical action between the whole of the points and signals at junctions. It was at Keymer Junction, near Hayward's Heath, on the Brighton main line, that this valuable invention was first used in actual traffic working, after Mr. Saxby had fully satisfied himself as to its practicability. The success achieved was so marked that he was immediately induced to open premises for the manufacture of the apparatus, and at one time he employed no fewer than 3,000 hands in the business. With the assistance of his partner Mr. Farmer, he also opened works in France and Belgium. Mr. Saxby, who has died in his ninety-second year, conceived the idea of interlocking points and signals as the result of an accident which he witnessed at Bricklayers Arms Junction, when a train was shunted upon the wrong line.

* * *

Retirement of Mr. Waddell, Chief Goods Manager, Caledonian Railway.

An important change in the personnel of the official staff of the Caledonian Railway Company is involved by the retirement of Mr. Matthew Waddell from the position of Chief Goods Manager after a long and highly respected career in the service of the Company. Mr. Waddell received his training in the office of the Goods Manager of the Glasgow and South Western Railway and after obtaining experience in various departments with that Company, and also in the service of the Glasgow and Paisley Joint Railway, he joined the Caledonian Railway under the late Sir James Thompson, then Goods Manager. When that distinguished officer was promoted to the position of General Manager, Mr. Waddell was appointed Chief Assistant to Mr. Hillhouse, who succeeded Sir James as General Goods Manager, until, on the retirement of Mr. Hillhouse, he was selected for the chief position in the goods department, which post he now vacates after filling it with conspicuous ability and success for the last six years. Mr. Waddell carries with him the regard and esteem of the trading community and the large staff of employees under his control alike. Mr. Waddell has been succeeded by Mr. Duncan Cameron, whose portrait appears on another page.

The Caledonian Railway advertised the special excursion bookings and trains to London from Scotland in connection with the recent International Football Match by means of mammoth posters, 42 ft. wide and 10 ft. 6 in. deep.

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An American correspondent favours us with the following items of news:—"A somewhat unique railway bridge has recently been constructed on the Oregon Trunk Railway, which is building through Central Oregon. It is composed of a single track cantilever span 340 ft. long, stretching from wall to wall of the Crooked River Canyon, at a height of 320 ft. above the river. It is believed to be the second highest railway bridge in the United States, the Pecos River Viaduct only exceeding it by a few inches.—The recent decision of the Supreme Court of the United States dissolving the merger between the Union Pacific and Southern Pacific railways is likely to considerably shake up the railway map of the West, and also forms another step in the dissolution of that wonderful operating organisation built up by the late Mr. Harriman. While details are not yet settled it seems that the two companies will cease to be partners in the art of economical handling of the traffic, but enter into active competition for business between California and Oregon and the East. The Southern Pacific handling *viâ* the 'Sunset Route' through Los Angeles and El Paso (Texas), and the Union Pacific by the old 'Overland Route' to the Great Salt Lake, and thence by its subsidiaries the Central Pacific to California points and the Oregon-Washington Railway and Navigation Co., to the Pacific North-west. The Central Pacific line from Salt lake to San Francisco and Fresno has hitherto been the property of the Southern Pacific, and been operated under their name, although they have always been required to keep the Central Pacific rolling stock intact, and to distinguish it this has in small letters the initials 'C.P.' Under the dissolution order the Central Pacific must be sold to the Union Pacific to provide their California outlet, and, while dominated by the purchasing company, it will probably be organised as a separate railway, and thus add another to the long existing list of 'foreign companies.'—The public health authorities of Washington still continue their activities, and the latest order is to the effect that drinking water supplied on trains engaged in interstate commerce must be certified by State or municipal authorities as being incapable of carrying disease, and all ice put in drinking water taken from a duly certified source and washed in 'safe' water.—In Lousiana a railway has recently been fined £20 by the State Railway Commission for not having a passenger car warm enough for the comfort of the public."

Photo] [*L.N.W.R.*

DOUBLE-ENDED COMPOSITE SLIP CARRIAGE: LONDON AND NORTH WESTERN RAILWAY.

* * *

The London and North Western Railway Company have constructed a double-ended slip composite brake, 57 ft. long by 9 ft. wide, consisting of two first and three third class compartments (with lavatory accommodation for each compartment) and a guard's compartment at each end, fitted with slipping apparatus. Teak is used in the framing of the coach body. It is panelled with mahogany (baywood) and the vehicle is painted in the standard colours of

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the company. The internal finish is designed with a view to simplicity, cleanliness, and facility for repairs. Walnut is employed generally for the interior decoration in the first class compartments, and polished teak in the third-class. Mirrors and photographic views in grey "cut-out" mounts, illustrating places of interest on the system, are fixed in removable frames over the seat backs. The upholstery is in moquette for first-class, and crimson and black rep for third-class, the ceilings and partitions down to the top of the cornice moulding in each class being painted white. Balance blinds enclosed in neat wooden hoods are provided for the windows, and luggage racks for light articles are fixed on the partitions. Efficient ventilation is supplied by means of torpedo vents in the roof and hinged flaps in side doors. Lavatory floors are covered with fire-proof material, all sharp corners being dispensed with, so as to facilitate washing out. First-class lavatories are finished in fumed oak lagging, and third-class in African mahogany lagging, vee-jointed and fixed vertically. The vehicle, mounted on an underframe made of steel sections, and carried on four-wheeled bogies, is fitted with the vacuum brake, electric light, and the "Wolverton" direct system of steam heating.

* * *

MR. MORLEY DONALDSON, Vice President and General Manager of the Grand Trunk Pacific Railway has announced that the Fort Garry Hotel at Winnipeg, the second in the company's projected chain of hotels across the continent, will be opened on October 1, or as soon as the formal ceremony can be arranged. The foundations of the McDonald at Edmonton are laid, and work has started on the superstructure. Work has not been begun on the Qu'Appelle at Regina, but it will be built this season. The new twin screw s.s. *Argentina* of the Austro-American Steamship Co., which has previously sailed between New York, Naples, Patras and Trieste, has been assigned to the Trieste-Canadian service, and arrived in Portland recently for the first time on her new route with 17 second and 933 third class passengers. Two other vessels—the *Frankfurt* from Rotterdam and the *Dominion* from Liverpool—reached Portland at the same time, and from the three 3,000 passengers were forwarded in special trains to points in Canada by the Grand Trunk Railway System. On four days immediately preceeding two thousand passengers from Halifax and Portland were carried by the Grand Trunk in seven special trains. This makes a total of 5,000 immigrants in as many days, forming a very satisfactory record for this period of the year.

* * *

The following important works are to be pushed forward during the present year on the Grand Trunk Railway of Canada:—The gap between the eastern and western heads of steel in British Columbia is now only 426 miles, and work on this portion of the line is under way throughout its entire length. Steel is laid to the Shuswap River, 1,123 miles west of Winnipeg, and 154 miles east of Fort George. A steel structure spanning this river will be placed in position as soon as footings have been completed. East of Prince Rupert the head of steel is 195 miles from the Pacific Coast. Between that point and Aldermere several steel bridges have to be erected. From Aldermere, easterly, the grade continues to the Endaka River, 341 miles from Prince Rupert. Then there is a gap of 126 miles to Fort George, upon which clearing work is being done. The Grand Trunk Pacific will enter the towns of Brandon, Moose Jaw, Weyburn, Battleford, and Calgary during the year, and will begin important extensions, including the finishing of the Weyburn branch and Regina boundary line, securing of terminals in Moose Jaw for the Regina-Moose Jaw branch (complete to a point north of Moose Jaw), the ballasting of the Battleford branch, and the construction into Calgary of the line from Tofield. On the line from Regina to the International Boundary grading is finished as far as Frobisher, 136 miles from the capital of Saskatchewan, steel is laid for 106 miles to Hill Hall, and 90 per cent. of the grading completed on the remaining portion between Frobisher and American territory. The grade on the Tofield-Calgary branch has virtually reached Calgary. Track is laid for a considerable distance, and ballasting operations will soon be begun along this line until Bow River is reached, when a halt must be called to allow of the erection of a steel structure. When that has been completed, track laying will proceed to Elbow River, at which point another steel bridge will be put in place. Concrete piers are ready for the bridges in both cases. Terminals are now being prepared, and the line should be in condition for the operation of passenger trains into Calgary at the beginning of August.

* * *

A RECORD of experience with feed-water heating and superheating apparatus as fitted to locomotives belonging to the Egyptian State Railways was presented in a paper read before the members of the Institution of Mechanical Engineers by Messrs. F. H. Trevithick and P. J. Cowan. Remarkable data as to results realised were quoted in the discussion. Several speakers asked for further information. Four types of apparatus are involved. Type A design is for feed-water heating only. There are four heaters in series, a pump exhaust heater, two main exhaust heaters, and one large heater in the smoke-box. This design gave place to type B, comprising the same elements. The large heater is of drum type, placed in the upper part of the smoke-box, and can be used either for feed-water heating or as a superheater. It gives, therefore, either high degree feed-water heating, or moderate feed heating and superheating. Type C apparatus includes a smoke-tube superheater of Schmidt type, with two main exhaust heaters and two drum heaters. Mr. C. J. Bowen Cooke (London and North-Western Railway) stated that on his line experience was that when very heavy loads had to be hauled efficiency fell. Experiments with feed heaters had not been very satisfactory. Mr. Churchward (Great Western Railway) suggested that valuable service to locomotive engineering would be rendered if a common fund could be raised for building a locomotive for experimental service on various railways.

* * *

UNDER the skilful direction of Major J. N. C. Kennedy, their Telegraph Engineer,

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the London and North Western Company will soon have the effective principle of "traffic-control" in full operation throughout the system. This simple and ingenious plan, which had its origin in the United States, has already been brought into use at Crewe, Wigan, Huddersfield, and Birmingham, and it is intended to establish in Crewe a "central control," which will be the most elaborate of the kind yet seen in this country. All the signal boxes on the line are being connected by telephone with the head control office, and the passage of every train from one block section to another is to be instantly telephoned to the controlling staff. Major Kennedy, who was formerly attached to the Royal Engineers, has effected great improvements in telephony, by means of which a single battery is sufficient for the purposes of a large number of stations. Men are being specially trained for this new work, and it is hoped that the system will in the course of the present year be in operation over nearly the whole of the railway.

A WRECK ON THE CANADIAN PACIFIC RAILWAY.

* * *

FOUR set trains, built at the Cowlairs works, appeared in the West Highland service of the North British Railway at the beginning of May. Designed by Mr. W. P. Reid, the company's Locomotive Superintendent, the new stock consists of exceedingly well-appointed coaches of the North British standard type, with side corridors, all steam heated and lighted by incandescent gas. Walls and ceiling in the first-class compartments are decorated white, and the upholstery is in blue carriage cloth. Similar white treatment is seen in the third-class compartments, where the seating is covered in red velvet carpet. All doors have an improved arrangement for excluding draught, and in the end compartments observation windows are fitted. Tiled walls and mosaic floors are introduced in the lavatories, and hot as well as cold water is always available. To minimise the risk of accident, the area surrounding the gas reservoirs has been rendered fireproof, and a check valve at once operates if a pipe should be broken. All the trains carry sets of emergency tools, as well as concussion fire extinguishers, the latter being placed in the luggage compartments of the brake vans.

* * *

THE Rev. V. G. Hobart, a reader of the RAILWAY MAGAZINE, resident in Canada, sends a series of photographs (one of which is here reproduced) showing the results of an accident that occurred a few weeks ago on the Canadian Pacific Railway, about two miles from Lennoxville. "The train was" he states, "the first part of an immigrant train running in two sections and containing about 750 passengers. The amazing part of the wreck was the fact that only two men required medical treatment, and these were able to proceed to Montreal on the following day. There happened to be an East bound empty train in Sherbrook. This was backed down to take off the passengers. It also waited for the immigrants in the second section to come along, and conveyed these as well. The position of the cars, especially in connection with the overturned freight car full of baggage, shows the narrow escape which many experienced." The photographs were taken by Mr. Hobart's brother less than an hour after the accident.

* * *

SINCE the use of steel panelling for the outsides of railway carriages has become more general in all the countries of the world, Messrs. John Lysaght, Limited, Orb Ironworks, Newport (Mon.), have experimented thoroughly to discover the most economical class of sheet that can be applied to the purpose, and it is generally accepted that their charcoal panel quality fulfils every requirement. A small extra first cost is more than repaid by the amount of labour saved in the paintshop in filling-up and rubbing-down. A conspicuous illustration of the great advantage of steel carriages was afforded in December last year, when a fast train was derailed in Pennsylvania. Although hurled down an embankment, the carriages were only slightly damaged, and no passenger was killed or gravely injured. Old-fashioned wooden carriages would, no doubt, have been shattered, and many passengers might have been killed and wounded in the absence of such firmly-built steel stock. The same company's charcoal panels are fitted to railway carriages in the principal countries of the world where English carriages are used—India, South Africa, South America, China, and Australia, as well as on many English railways. Messrs. Lysaght also supply steel railway wagon body sheets, many of which are now seen upon Indian, Colonial, and foreign lines.

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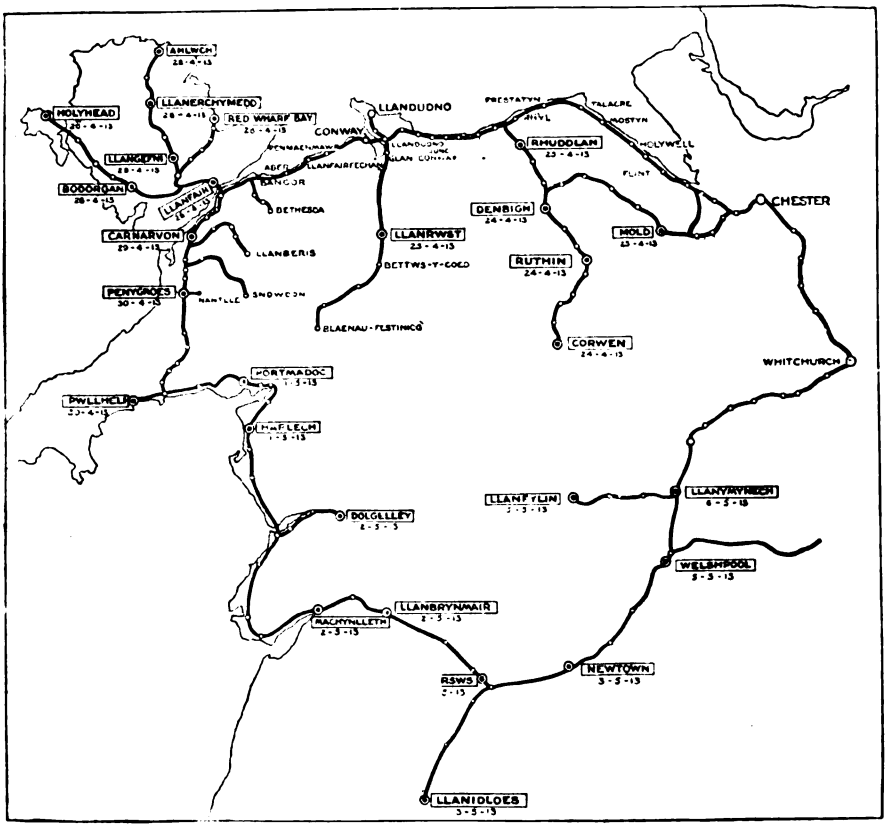
On Wednesday, April 23, the North Wales Egg and Poultry Demonstration train left Euston for a fortnight's tour in North Wales, arranged by the Agricultural Organisation Society and the National Poultry Organisation Society. Two main line bogie vans were specially fitted up and a dining car for the staff and visitors was included in the equipment. The accompanying map gives the dates fixed for each demonstration.

Illustrated Guide, just issued, contains descriptive notes relating to nearly ninety different places on the system. Particular attention is paid to Bournemouth, Bude, Dartmoor, Hindhead, the Isle of Wight, the New Forest, Southsea, Salisbury, Weymouth, and other popular centres, to which constantly increasing streams of holiday traffic are directed. A list of the golf links situate near the Railway shows that the Company's passengers now have the



MAP SHOWING ITINERARY FOR THE NORTH WALES EGG AND POULTRY DEMONSTRATION TRAIN: LONDON AND NORTH WESTERN RAILWAY.

The vans contained a number of exhibits expressly provided for the purposes of the demonstration—models of poultry houses, trap nests, an incubator, brooders, chick boxes, marking rings, netting, and egg boxes. Other exhibits were connected with the preparation of table poultry, with fattening cages, shaping boards, and cramming machines. There were also large quantities of eggs of various qualities, together with exhibits of dressed fowls. A section in one van formed an egg testing room, fitted with electric testing lamps and appliances. Photographs and diagrams adorned the walls, and a staff of lecturers and demonstrators travelled with the train. Leaflets in English and Welsh were distributed at each demonstration.

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The fifteenth annual edition of the London and South Western Railway Company's Official

choice of no fewer than 128 different 9 and 18-hole courses, of which 107 are situate in the South Western and Western Counties of England, nine in the Isle of Wight, five in the Channel Islands, and seven on the Coast of Normandy and Brittany, to which steamers run regularly from Southampton. In 1903 the total number of links on the system was 70, so that during the last ten years no fewer than 58 new courses have been laid out near the Company's system. The Guide, again prepared by Mr. W. Turner Perkins, contains exactly the information which the ordinary traveller requires.

* * *

The *London and North Western Railway Gazette* publishes the following remarkable example of continuous railway service, extending through four generations, and representing a total period of 530 years. It is supplied by

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Mr. H. Clench, of the London and North Western telegraph office at New Street station, Birmingham.

No.	Names.	Relation to A.	Duty.	Station.	Years. of Service.
1	Clench, W. J.	Grandfather	Chief Booking Clerk	Rugby*	40 D
2	,, C. H.	Father	Loco. Fireman	Stafford	41 P
3	,, H.	A	Telegraph Clerk	Birmingham	31
4	,, C. H.	Son	Clerk	Birmingham D.S.O.	4
5	Buszard, M.A.	Mother	Refreshment Department	Rugby	4
6	Clench, W.	Brother	Telegraph Clerk	Greenfield	14
7	,, T.	,,	Clerk	Warwick	4
8	,, C.	,,	,,	Manchester	19 L
9	,, F.	,,	,,	Stafford	7 L
10	,, E.	Sister	Refreshment Department	Various	5 L
11	,, M.	,,	,, ,,	,,	5 L
12	,, D	,,	,, ,,	,,	3 L
13	,, W.	Uncle	Cashier Parcels	Euston	45 P
14	,, T.	,,	Express Driver	Rugby	42 P
15	,, R.	,,	Driver	,,	45
16	,, J.	,,	Station Master	Coventry	17 L
17	,, J.	,,	Goods Agent	Aylesbury	36 D
18	,, W.	Cousin	,, ,,	Spon Lane	35 D
19	,, J. M.	,,	,, ,,	Mont. Lane	28
20	,, J. W.	,,	Booking Clerk	Various	10 L
21	,, E.	,,	Refreshment Department	,,	5 L
22	,, W.	,,	Loco. Department	Rugby	2 L
23	,, W.	,,	Clerk	Euston	35
24	,, A.	,,	Refreshment Department	Various	9 L
25	Moreton, J.	,,	Clerk	Oldbury	34
			Total years of Service		530

D—Deceased. P—Pensioned. L—Left Service.
* Also the London and Birmingham Company from about 1821.

ANOTHER family record mentioned in the same publication occurs at Mold Junction, where there are a father and his seven sons, almost capable of working a section of the line by themselves, a fireman only being wanted. The following are the members of the family :—

Henry Chilton, the father, Signalman.
John Chilton, son, Engine Driver.
Philip Chilton, son, Breaksman.
Thomas Chilton, son Booking Clerk.
Ernest Chilton, son, Breaksman.
James Chilton, son, Shunter and Relief Signalman.
William Chilton, son, Porter.
Frank Chilton, son, Messenger.

* * *

THE first of the latest series of the Great Western four-cylinder simple express locomotives of the 4–6–0 type was put to work on local services in the Bristol and Swindon district towards the end of April. She bears the number 4041, and the name *Prince of Wales*. Both the Great Western and the London and Northern Railway thus possess a 4–6–0 engine named *Prince of Wales*. The latter engine, numbered 819, and illustrated by the coloured plate in the April RAILWAY MAGAZINE, is one of Mr. C. J. Bowen Cooke's developments of the late Mr. G. Whale's "Experiment" type. On the Great Western Railway the name *Prince of Wales* was formerly borne by No. 1132, one of the seven feet singles (2–2–2 type) which performed so much important express work on that line until the close of the 19th century. No. 4041 is the 42nd four-cylinder express engine to be put into service on the Great Western Railway. This type is now known as the "4000" class, the series being headed by *North Star*, originally built as a four-cylinder simple "Atlantic," and at first numbered "40." The practice of painting over the safety-valve casing on the fire-box of the older types of Great Western locomotives still continues. It has now extended to the 7 ft. 8 in. singles, one of which, No. 3062, *Albert Edward* recently made her appearance in this condition. Several of the goods tender engines (0–6–0 type) and certain of the *Duke of Cornwall* class (4–4–0) have been similarly treated.

* * *

LIKE its predecessors the recent Annual Concert held under the auspices of the Metropolitan Railway Company in aid of the Railwaymen's Convalescent Homes, at Herne Bay and Leasowe Castle, was an unqualified success and the selection of the Queen's Hall as the concert room was amply justified by the large attendance. Mr. W. F. Smith, was hon. secretary for the concert. Mr. R. H. Selbie, general manager, Metropolitan Railway, presided, and in the interval addressed the gathering, thanking Mr. Alfred de Rothschild for having kindly placed the Viennese Orchestra at the disposal of the Committee, and the artistes who ungrudgingly had given their services free. The cost of the building at Herne Bay, including land, amounted to £23,000, and Leasowe Castle £15,000, and maintenance per annum £5,000, an average of £100 per week. The total number of patients in the homes to date were: at Herne Bay 15,653, and at Leasowe Castle 1,111. This year the number of patients from January to date were: Herne Bay 1,846,

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Leasowe Castle 568. Taking every day in the year for 1912, with the exception of Sundays, there was an average of five railwaymen per day sent to the homes. The increase this year to date was 10 per cent. Herne Bay and 26 per cent. Leasowe Castle for the corresponding period of last year. The Chairman added that a scheme which had not before been made public had now been brought forward by the Southern Companies, whereby a Home was to be established for the womenfolk. A site was being considered by the trustees (at Herne Bay), and it would be worked in every respect on separate lines from the present Homes.

* * *

At the headquarters of the Railway Club, Mr. E. J. Miller delivered, on April 22, an instructive lecture upon "The Railways of the Grisons." These Swiss lines comprise the Rhaetian and the Bernina Railways, the first worked by steam and the latter by electric power. Their combined length is about 230 miles, and they form the largest network in Switzerland of metre gauge lines. Mention was made of the more notable bridges and engineering achievements; also of the Albula tunnel, the largest in the world, constructed for the metre gauge. The mountainous and difficult character of the country necessitates gradients of 1 in 23 and 1 in 14½. Bernina Railway reaches the highest altitude of any railway in Europe—except rack-worked systems—namely, at the Bernina Hospice station, 7,400 ft. At this point heavy snowfalls are experienced in winter, usually necessitating a partial closing of the line each year. Nearly 50 lantern views, taken chiefly by the lecturer and his brother, were shown, and these exhibited the extraordinary difficulties which had to be overcome in the construction of these railways. Much interest was manifested in the pictures of the rolling stock, permanent way and stations, and Mr. Miller was warmly thanked for his valuable contribution.

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During the last few years, compressed asbestos fibre jointings have taken a great hold on the market, and it is conceded that this class of jointing ranks in the forefront of sheet packings. With such appreciation, it is only to be expected that a large number should have been produced, including some of indifferent quality and at low price. But one of the best known jointings of the class is that manufactured by Messrs. James Walker & Co., Ltd., of Garford Street, Poplar, well known as "Golden Walkerite." This is composed of the best grades of fibre and Para rubber, and Messrs. Walker's wide experience in jointings and packings—as the makers of the well-known "Lion" Metallic packings—enables them to deal with such matters in a special manner. Although the distinctive feature of the material is a golden surface, it serves a further purpose in that it prevents the jointing adhering to the flanges. Messrs. Walker, who have a large sale for "Golden Walkerite," manufacture it in sheets from about 36 in. square up to 80 by 40 in., and in all thicknesses from 1/64 in. upwards.

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A Birmingham correspondent writes as follows:—"I am a constant reader of the Railway Magazine, and was much interested in Captain Lendrem-Ainslie's letter on 'England's All-Red Route,' which appeared in the 'Pertinent Paragraphs' of the April number. I think these repeated slowings of the Scotch services—and, indeed, of most of the express services—of the Midland line are most annoying, and trust with your correspondent that we shall see a material improvement this summer. The Scotch traffic from Birmingham is being absolutely starved. Many of my friends would spend their holidays in the Highlands or on the Clyde, but will not face the railway journey, the return trains, both day and night, being very slow—indeed, the night trains are quite impossible. I should have thought, too, that a good fast week-end express to Scarborough and the Yorkshire coast would have attracted traffic from the large Midland towns. I am glad to see that this matter has aroused interest, and that you have given prominence to it in your valuable and widely circulated magazine."

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We are authorised to state that there is no foundation for the announcement recently made in some of the daily newspapers that the Managing Committee of the South Eastern and Chatham Railway have arranged to introduce restaurant cars in their Kent Coast service. It is, of course, quite possible that such cars may eventually be seen running to and from Margate and Ramsgate, but, at any rate, nothing of the kind has yet been decided upon. Improvements are being made at Margate West station by the construction of an additional platform, which will be extremely valuable during times of pressure, and there is also under consideration a scheme for building another large station which will more amply provide for the enormous passenger traffic of Cliftonville.

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The Isle of Wight and Isle of Wight Central Railway Companies have combined in issuing a very useful tourists' handbook, hotel, commercial and boarding house guide. Every facility is now offered by the companies for seeing the most beautiful parts of the Island, and the local carriage proprietors provide trips by coach and wagonette to points not served by the railways. Local railway fares have been revised, and for the most part the third class fares are now on the mainland basis of 1d. per mile. In addition excursion tickets are issued daily at exceptionally low rates. Marine excursions may in the season be made by well equipped steamers to Portsmouth, Southampton, Bournemouth, Weymouth, Swanage, Brighton, Cherbourg, and round the Island (touching at Alum and Totland Bays). For the convenience of tourists exploring the island, weekly season tickets, available for seven days by any train, are issued at any island station (except Ryde Esplanade and Pier Head) at reduced rates. The guide contains an excellent map of the island.

* * *

Visitors to the Shakespeare Festival at Stratford-on-Avon will welcome the re-appearance of the useful little guide of the "S.M.J." Railway, which has been distributed throughout the United Kingdom, and, by permission of the principal steamship companies, placed in the ocean liners. The booklet contains not only a map of the "Shakespeare Route," but a plan of Stratford, and many illustrations, including, of course, one of the Manor House at Sulgrave, the

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ancestral home of George Washington, which is reached from Morton Pinkney station, on the Stratford-upon-Avon and Midland Junction Railway. Attention is called to the establishment at Stratford-on-Avon of a Vacation School of Folk-song and Dance, in connection with which two sessions are held every year at the summer festival in August and during the week after Christmas.

* * *

In connection with the recently introduced scale of salaries, the directors of the Caledonian Railway Company, have inaugurated a scheme for the periodical testing of the efficiency of the clerical staff throughout their entire system. Embraced in the examination are English, arithmetic, and geography as compulsory subjects, in addition to which there are certain optional subjects such as accounting, bookkeeping, shorthand, typewriting, telegraphy, block working, the company's rules and appendix to the working time table. The first of these examinations—attended by clerks from all parts of the system—was held in Kent Road Public School, Glasgow, on Saturday, April 19, and the second later in the month. On the latter occasion, Sir Charles Bine Renshaw, Bart., Chairman of the Board of Directors, addressed the candidates, and emphasised the mutual advantages to be derived from improved intellectual efficiency, which was, he said the crying need of the day. The examinations—which are not in any way competitive, but are simply qualifying—will be held twice a year, namely, in April and October.

* * *

The old colleagues of Mr. J. H. Vickery in the general offices of the London and South Western Railway at Waterloo station have presented him with a handsome canteen of silver and an album containing the names of the subscribers, as a memento of the high appreciation in which he was held by the staff generally before leaving London to take up his present position as General Manager of the Alexandra (Newport and South Wales) Docks and Railway Company. Mr. H. A. Walker, the General Manager, was, unfortunately, unable to be present when the presentation was made, and in his absence, Mr. J. W. Jacomb-Hood, the Chief Resident Engineer, performed the duty with singular appropriateness, inasmuch as he and Mr. Vickery entered the company's service within a few weeks of each other 37 years ago.

* * *

"Per Rail," a unique publication issued by the Great Central Railway Company, gives particulars of the railway facilities and arrangements for the conveyance of goods and merchandise traffic. But while this statement of its object suggests a traders' handbook, the volume provided is worthy of inclusion in any library. Arranged in appropriate divisions is a comprehensive treatise describing the scope and machinery of the goods department of the Great Central Railway, and setting forth the industrial characteristics and possibilities of the manufacturing districts and centres served by the railway. The book contains numerous half-tone illustrations, a bird's-eye view of Immingham, a colliery and an industrial map, and a physical map of the railway. Copies may be obtained by traders on application to Mr. T. W. D. Smith, Publicity Department, Great Central Railway, 216, Marylebone Road, London, N.W.

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The Pennsylvania Railway Company have constructed for use in the streets of Altoona an electric tractor, which is intended to replace string teams for hauling cars over railroad tracks in city streets for delivery to local industries. One of the remarkable features of the car is that it drives, steers, and brakes on all four wheels, and the axle is the largest ever built. Of the tangent spoke type, the wheels are steel castings, weighing approximately 1,200 lbs., and are equipped with steel base solid rubber block tyres of a design which enables one section to be removed and replaced without disturbing any other. Weighing 28,850 lbs., the car has a normal light speed of 6 miles an hour. Its normal drawbar pull is 8,000 lbs., and the maximum drawbar pull 21,500 lbs.

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"La Science et la Vie" for April, the first number of a new French periodical, published in Paris, contains an article describing the safety equipment of a railway. The writer deals mainly with French methods of signalling, and several appropriate illustrations are included. From our point of view, however, the comparison made between certain French signal gantries of a complicated character, as installed at large stations and busy junctions, and some English equipments—for example, the famous signal gantry south of Rugby, London and North Western Railway—is strongly in favour of British methods. In fact, the term "Signaux Anglais extra-visibles," expresses the prevailing characteristics of signalling as practised in the United Kingdom. Locking apparatus, point mechanism and other safety appliances are also considered. The publication includes a photograph of an "Est" 4-6-0 locomotive, equipped with hose and pumps for use in case of fire.

* * *

On the London and North Western Railway the first five of a new series of "George the Fifth" (superheaters) are now running—Nos. 681, *St. George;* 845, *Saddleback;* 1188, *Penmaenmawr;* 1680, *Loyalty;* and 2086, *Phaeton.* A further nine four-cylinder simple engines are under construction, and will be put in hand shortly. They will bear names of directors of the company. A new erecting shop, making the tenth of its kind, is to be built. The original No. 1 Shop is now used for stripping purposes, but no repairs are carried out there.

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The annual competition for the Scottish Railways Ambulance Shield was held on Saturday, May 10th, at the Barassie Works of the Glasgow and South Western Railway. The contest was confined to ambulance teams which had won first or second places in competitions already decided by the respective railway companies, and constituted a kind of championship. The competition resulted in the shield and gold badges being won by Newton-on-Ayr team, 265 points, Queen Street (passenger) team being second and winning the silver badges with 264 points. Methil (North British) was third with 261 points. The presentation of the cup and badges was made by Mr. D. Cooper, general manager, Glasgow and South Western Railway.

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UNDER the presidency of Mr. Stanley Baldwin, M.P., the fifty-second anniversary festival of the United Kingdom Railway Officers' and Servants' Association held at Hotel Metropole, London, was an unqualified success. On behalf of the Committee of Management, Mr. E. E. Thomas, of the South Eastern and Chatham Railway outlined the work of the Association, which is intended mainly to help the thrifty and those who for a number of years have paid a subscription of 6s. per annum towards an annuity for themselves or their widows. In this way the Association provide upwards of £2,000 every year for old people, the subscriptions from members amounting to only a fractional part of the sum required. Mr. James (secretary) read a list of subscriptions, representing a total of £2,370, being an advance on the previous year of £250.

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EVER enterprising in its publicity work, the Great Western Railway Company, have issued three sectional or local guides to famous districts on their system—(1) "The Cornish Riviera," (2) "Devon—The Lovely Land of the Mayflower," (3) "Shakespeare Land," and others of the same series are promised. Small enough to be carried without any inconvenience, the books are admirably produced—carefully written, well printed and liberally illustrated—and a single-folder inset contains on one side a map showing Great Western Railway routes from ocean ports to the different districts selected for attention, and at the back an equally useful map of the particular section described in each book. Guides of this description, produced by railway companies themselves, are always welcomed by the public.

* * *

THE Lancashire and Yorkshire Railway Company have issued their annual illustrated guide, which, in addition to a description of the many popular resorts on the system, contains a list of the hotels, boarding establishments and other places where visitors may obtain accommodation. Information respecting the Zeebrugge route to the continent is added, and further variety in the Company's services is offered by its delightful Irish tours *viâ* Larne. Copies of the book may be obtained from Mr. A. Watson, Superintendent of the Line, Lancashire and Yorkshire Railway, Manchester.

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REPEAT orders for the "Robinson" Superheater have recently been placed by the following railways:—Caledonian, Great Northern, North Eastern, Great Central, Buenos Aires and Pacific, Central Argentine and Leopoldina. The London and South Western, Manila, Ceylon Government, North British, San Paulo, Egyptian State, Midland Great Western (Ireland), North Staffordshire, Buenos Aires Western, Bengal Nagpur, Great Eastern, Lancashire and Yorkshire, Central Uruguay and Buenos Aires Great Southern Railways have given orders for this apparatus to be installed.

* * *

BY the death of Mr. James Walker, the well-known firm of James Walker & Co., Ltd., of "Lion" Works, Garford Street, Poplar, London, loses its founder and chairman. Mr. Walker died at his residence in Leytonstone on May 8, at the age of 73. "Lion" metallic packings and other specialities of the firm are largely used in railway work, and Mr. Walker was well known among locomotive engineers. The management of the company will be conducted as before, under the guidance of Mr. George H. Cook, managing director, and the lamented death of Mr. Walker will not occasion any change in the organisation of the business.

* * *

BEGINNING on May 1, electric traction was extended from Town Green and Aughton to Ormskirk, Lancashire and Yorkshire Railway, and the train service between Liverpool and Aintree, *viâ* Walton Junction and Ford, were revised and augmented. The new schedules provide frequent trains on the routes named, and include many fast or semi-fast facilities.

* * *

LAST year 7,341,649 railway sleepers were consumed in Canada, the year before about 6,841,649, and in 1907, 5,200,000. Among the woods used were cedar, oak, hemlock, spruce, fir, tamarack, pine, and chestnut. Of tamarack 1,000,000 sleepers were made, and of cedar, which ranked next, 875,000. Oak sleepers are by far the most expensive in Canada.

* * *

AT a recent meeting of the Institution of Railway Signal Engineers held in the Queen's Hotel, Leeds, a paper was read by Mr. A. Hurst (Signalling Engineer, North Eastern Railway) on "Colours and Colour Blindness," the contribution having for its main object the determination of the best colours to be used for signalling purposes.

* * *

NEW luncheon and dining car expresses will be added on June 1 to the London and North Western Railway Sunday services between London and Birmingham and Wolverhampton. The down train will leave Euston at 12.30 p.m. (noon) and call at Willesden, Coventry, Birmingham (New Street), and Dudley Port, reaching Birmingham at 2.40 p.m. and Wolverhampton at 3.10 p.m. The return service will leave Wolverhampton at 6 p.m. and Birmingham at 6.25 p.m. reaching Euston at 8.35 p.m. with stops at Coventry and Willesden only.

* * *

THE whole of the recent contract for supplying the silent chain drives required for the equipment of the new shops of the Bombay, Baroda and Central India Railway has been awarded to the Westinghouse Brake Co., Ltd., the makers of the Westinghouse-Morse Silent Rocker-Joint chains.

* * *

Mr. C. WILLIAMS, 15, Peel Street, Crewe, has issued a new supplementary list of London and North Western engines. Corrected to date, the book is offered at sixpence net. The original list, published in 1912, is still on sale at 1s. 6d. net.

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OWING to the closing of the Port of Dublin, except under very stringent restrictions, during the whole of the last six months, the live stock traffic of the Midland Great Western Railway of Ireland Company suffered a loss of £13,000

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